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EDITORIALS

STICKING TO A SPECIALTY.

Many electrical contractors doing a small local business in house-wiring have become familiar with every detail of this class of business, both in new and in already-built houses, and have wiremen who are also accustomed to handling this work expeditiously and well. Where the work is systematized, all material necessary for a job is sent in one haul to the premises and the installation proceeds without a hitch. Costs are kept at a low level by the elimination of unnecessary wastes and delays, and overhead expense is also kept at a minimum, although this element of cost is necessarily a larger percentage of small jobs than of large ones. A small concern is thus often able to handle small residence work at lower costs than larger competitors and can often bid under the latter on such contracts. This is sometimes attributed to deliberate price-cutting or ignorance of actual costs, when it may in reality be due to experience and efficiency in that particular line of work.

Other firms, again, may have specialized on office buildings, theaters, hotels or factory buildings. Each has special features which may require special planning or unusual work in execution. The organization which is habituated to meeting these special requirements can carry them through with less expense and less friction than any other. The contractor unused to such a job needs to figure a generous amount for contingencies in making his estimate. Failure to do so may bring him a contract which in the end means loss. The contractor who has been successful in one line of work is prone to venture into others without fully realizing the requirements. Profits may have been gradually piling up on small contracts only to be wiped out at one stroke in an attempt to handle a large contract in a slightly different field for which insufficient preparation was made, due to a lack of knowledge of all of the requirements.

Cultivating a specialty and then sticking to it as closely as seems feasible has great merit in electrical contracting, as well as in other lines of endeavor, and the man who travels the road indicated by this sign post has greater chances, other things being equal, of achieving success from both the financial point of view and that of actual accomplishment, than the man who aimlessly follows the path that haphazard circumstances may direct his steps to. Numerous examples will occur to the reader.

INSULATING JOINTS FOR FIXTURES.

There are certain points in electrical practice where the best construction for avoiding fire hazard seems to conflict with the provisions which would insure greatest personal safety or freedom from accident. In the minds of some, this statement applies to the grounding of the secondary circuit of transformers which supply a low-voltage load, as is evidenced by some of the correspondence which has appeared in recent issues.

Another instance of this kind is the use of an insulating joint in fixtures for electric lighting. A rule in the National Electrical Code prescribes such a joint between the fixture and the supporting pipe or other grounded metal structure. There is a provision, however, that it may be omitted with straight electric fixtures when the insulation of the conductors within the fixture reaches a specified standard which is higher than the minimum ordinarily required, and the socket is so designed that a porcelain or equivalent insulation is interposed between the live metal parts and the outer metal shell. The aim of this rule is evidently to provide against a short-circuit in case one of the fixture wires becomes grounded upon the fixture through a defect of the insulation. Since for fixture work, wires may be as small as No. 18 B. & S. gauge and the insulation may be as thin as one-sixty-fourth of an inch, it is realized that such accidental grounding may easily be caused. If such a ground is produced upon a combination gas and electric fixture, it is quite possible the spark or heat otherwise developed by a short-circuit may melt a hole in the gas pipe and ignite the gas and a destructive fire might possibly be kindled. There is also to be considered socket burnouts which occur when the ordinary brass-shell socket is installed in a grounded fixture. The fiber lining does not seem to be sufficient to prevent short-circuits when the inner or screw contact shell is connected with the ungrounded conductor of a grounded circuit. The requirement of an insulating joint in combination fixtures consequently seems to be a reasonable one from either standpoint.

In the case of straight electric fixtures, however, there is little inflammable material about a fixture which might start a conflagration. On the other hand, with the fixture insulated, contact with it of an ungrounded conductor will raise it to the same voltage as this conductor and any one touching it is likely to receive a shock which may occasionally be,

even with voltages no higher than 150, fatal. Such a possibility would be obviated by having the fixture grounded and would seem with proper socket equipment to outweigh any fire hazard which might arise from having it grounded. The Code does not permit such grounding, however, if ordinary fixture wire and sockets have been used in the fixtures. It would seem wise to make such grounding not only permissible, but mandatory in all straight electric fixtures, even if this must be accompanied by a requirement for better insulation of the wiring and sockets in such fixtures. Straight electric fixtures do not present the same restrictions of available space for the electric conductors as are found in combination fixtures, and it would usually be possible to use conductors having insulation equal to that of the rest of the wiring system in fixtures of this class; but even if such better grade of wire is not required, it would seem better to require the grounding of the fixture wherever the hazard from illuminating gas is not present.

The wider introduction of wall switches and pendent switches, and the elimination of key sockets, make the liability of contact with live fixtures more remote, and where fixtures are placed out of reach, such liability is almost negligible. The bathroom, however, has proved to be one of the places of greatest danger, and it is here that key sockets and wall brackets most firmly persist. The question is consequently not one which will be immediately solved by changing conditions.

THE ATTITUDE OF METER READERS.

A central-station company is known to the public through its employees. Their attitude and behavior determine the impression of the company which is held by a majority of the community. One point of contact is in the office of the company. Another is through the meter reader, who comes into contact with every household using the service. Frequently this contact is with some other member of the household than the one who negotiated with the contract department for service. To many, then, the meter reader is the only employee of the company who is known, and this emphasizes the fact that he should be truly representative of the policies and attitude of the company.

Tact, common sense and courtesy upon the part of meter readers, especially if combined with a policy of giving all information which comes within their ken, can do much to forestall complaints and prevent dissatisfaction with the service. High bills can often be explained by a little observation of conditions existing in the home and the statements of servants as to the extent of evening entertainments carried on. Many consumers do not realize to what extent consumption for lighting varies at different seasons of the year, and a suggestion along this line may be enlightening. Suggestions for eliminating carbon lamps will also frequently be found timely, as the average layman does not yet properly appraise the difference in efficiency between the carbon and tungsten types. The carbon lamp will never be completely driven out until both types are supplied by the central-station company upon the same basis.

It is worth while for the manager of a central station to see that his metermen are prepared to talk intelligently along these lines and that they are disposed to be observing as well as polite and attentive while out upon their rounds. When complaints are received by metermen which they cannot satisfy, it should be the definite practice to report them at the office, so that when conditions warrant it a call may be made by another representative. Ignoring causes for dissatisfaction is a prolific breeder of the spirit of antagonism in the community which has so often been manifested toward public utility corporations.

FLEXIBLE STREET-LIGHTING AGREEMENTS.

Satisfactory lighting of streets in small towns handicapped for funds sufficient to install or maintain a comprehensive system is a good deal of a problem. In one instance, at Monson, Mass., where a new board of selectmen inherited this question, a working agreement has been entered into for the time being which promises reasonable satisfaction. After many interviews with residents of different neighborhoods, the problem became so difficult that the board could not decide upon a regular contract and devised the following tentative plan.

The public desired lighting at least one-half hour earlier in the evening than last year; that the service be continued each night until 12:30 or 1 a. m.; that the lamps be turned on mornings during December, January and February from 5:30 a. m. until daylight; and that there be no moonlight schedule. On account of the limited appropriation it was thought best to forego a contract. It was agreed with the local central station that the lamps should be turned on a half hour after sundown instead of an hour thereafter, and that they should be cut off at midnight unless there are entertainments, dances, etc., scheduled, when, if the selectmen are notified, the service will be continued until 12:30 or 1 a. m., as occasion demands. The early morning service is to be continued as in the past. To offset the extra hours called for by the agreement, and to enable the town to remain within the appropriation, the selectmen are to notify the lighting company on nights when the moon is full, when the weather is clear, and when there is no foliage on the trees, to turn off the lights. The company agrees to turn them on as soon as notified should the weather become cloudy, or should lamps be required for any other reason. Although the arrangement is a partial return to the usual moonlight schedule, it offers a partial solution of the local difficulties, and is likely to yield more satisfac-

tion to the community than a cast-iron arrangement which would less readily conform to the conditions.

ECONOMY OF THE ELECTRIC TRUCK.

Operating expense and fixed charges should be carefully distinguished in considering the cost of transportation with motor trucks. Fixed charges are primarily associated with time, and their amount per ton-mile or per mile depend largely upon the distance covered. Total operating expense varies more nearly as the distance traversed, so that the unit cost is less variable. Depreciation charges contain two elements, one being dependent upon time and the other upon use (or abuse), so the allowance per unit of travel will vary differently with conditions from either of the above.

Other things being equal, fixed charges per unit of service are lower the more continuously the service can be rendered. Here is a point of advantage for the electric truck, which experience has shown to lose very few days out of service on account of necessary repairs or other attention—in marked contrast to its gasoline rival. This point deserves fully as much consideration in picking out the best vehicle in any given case as the first cost of the vehicle itself.

Operating expense in both cases includes repairs, renewal of tires, care and energy consumption. Repairs are notoriously more numerous and costly for the gasoline car, and tire expense points in the same direction. Energy in the one case is supplied in the form of electric current, in the other in the form of gasoline. Electric current has for years been diminishing in price and still shows the same tendency. There is no reason to anticipate any change in this situation. The purchaser of an electric truck can feel assured that the cost of energy for operating it will, throughout its life, be no greater than it is today, and the likelihood is that it will be less. Even in localities where the unit price of electric energy seems high, it must be remembered that the crux of the situation does not rest here. The energy charge is not more than one-quarter of the expense of operating an electric truck, and in many instances it is a great deal less than this. Consequently one cannot go very far astray in assuming that, for those types of service where electric transportation has been shown to be cheaper elsewhere, it will be cheaper also at home, regardless of the local rates for electric current.

The cost of gasoline, on the other hand, has shown an exceptional ability to increase, and while its future is very uncertain, there is no reason for believing that it will ever again reach a low level. This has already had the effect, it is claimed, of putting numbers of machines out of service. The price of gasoline has more than doubled in a very short time, and there is every prospect of a further advance. The one hope of checking this advance lies in the artificial production of larger quantities of the lighter oils from crude petroleum by the so-called cracking process. Recent experiments have indicated that this can be done far more successfully than had been anticipated from previous work. One method consists in an appropriate heat treatment of the heavier oils under pressure, which has the effect of breaking them up into more volatile forms. The most favorable conditions seem to be a temperature of about 550 degrees centigrade and a pressure close to 300 pounds per square inch. Another method subjects a mixture of heavy oils and natural gas to an electric discharge, with similar results. Such processes will greatly increase the supply of gasoline, but it is doubtful whether this will do more than arrest the rapid increase in price. The consumption has been increasing by leaps and bounds, and in 1915 reached 35,000,000 barrels in this country alone. This is an increase of about 25 per cent over the domestic consumption for 1914. Should demand continue to increase at this rate, there is little likelihood of relief from excessive prices.

This is the condition which confronts the purchaser of the gasoline car today, and it makes a strong talking point for the electric-vehicle salesman. Electric-vehicle manufacturers are experiencing an unprecedented demand for their output, and this condition may be expected to continue, keeping the factories running at full capacity. The advantages and economy of the electric truck are rapidly receiving general recognition.

IRRESPONSIBLE COMPLAINTS.

One phase of regulation of public service corporations by state utility commissions which has proven unsatisfactory to corporation officials is in connection with the complaints of irresponsible persons. Any individual is, of course, free to enter complaints against a utility corporation, but in many cases the complaints are made under a misapprehension or without inquiry into the facts of the case. If a hearing is arranged by the commission and the complainant attempts to gather evidence to support his complaint he discovers the lack of foundation for his case, and may fail to appear at the hearing. The case is then, of course, dismissed. In the meantime, the utility officials have gone to considerable trouble and possibly expense also, and may have neglected other duties in order to prepare a defense, all of which effort is found to be wasted.

It would relieve utility officials of an unnecessary burden if some way could be found to avoid placing such hearings upon the calendar. No case should be taken up formally unless it can be assured that the complainant has a *bona fide* case and intends to actually prosecute it. Perhaps the easiest solution of the difficulty would be for some member or employee of the commission to first take up cases informally in private conference, and find out whether any real ground exists for a formal hearing before one is scheduled. Many of the state commissions are already carrying out a practice which results in settling a large proportion of complaints without formal hearings, and if this procedure could be carried to the point of avoiding such instances as that cited above, it would prove an advantage to all concerned.

Happenings in the Industry

Vehicle Program for N. E. L. A. Convention—Plans for American Institute Meeting at Washington—Artists to Compete for Electrical Week Design—Program of Northwest Electric Light and Power Association—Electrical Exports for January—Boston Street-Lighting Contract to Be Arbitrated—Miscellaneous News Notes

Electric Vehicle Day at N. E. L. A. Chicago Convention.

A conspicuous and important feature of the forthcoming convention of the National Electric Light Association at the Congress Hotel, Chicago, May 22 to 26, will be Electric-Vehicle Day under the auspices of the Electric Vehicle Section of that organization. The following is a partial list of papers arranged for presentation on Electric-Vehicle Day at the convention: "Central Station Assistance in Promoting Electric Vehicle Use," by W. P. Kennedy; "Exchange Battery Systems," by P. D. Wagoner, president, General Vehicle Company; "Passenger Vehicle Problems and Activities," by E. P. Chalfant, Anderson Electric Car Company; "Greater Garage Service," by Harry Salvat, Fashion Auto Garage, Chicago; "The Relation of Tires to Electric Vehicle Efficiency," by S. V. Norton, B. F. Goodrich Company; "Electric Truck Troubles and How to Minimize Them," by F. E. Whitney, Commercial Truck Company of America; "Industrial Truck Applications," by C. W. Squires, Jr., General Vehicle Company.

Arrangements for Washington Meeting of American Institute.

A meeting of the American Institute of Electrical Engineers will be held at Washington, D. C., on Wednesday, April 26, 1916, under the auspices of the Washington Section and the Committee on Development of Water Power. Headquarters will be at the New Willard Hotel.

Two sessions are to be held, the first beginning at 2:30 o'clock in the afternoon, and the second at 8:15 o'clock in the evening, both devoted to the specific question of water-power development as related to national industrial efficiency and preparedness.

The appointment by the president of the United States to the Naval Consulting Board of men nominated by the national engineering societies, and the president's subsequent invitation to those societies to co-operate by recommending engineers who should assist in making an inventory of national resources, indicate a broadened field of useful service to our country which engineers as a body can perform.

The forthcoming meeting has been suggested by the Committee on Development of Water Power, which sees a further opportunity for service to the nation by directing the attention of the public and of Congress to the fundamental engineering and economic principles that underly the water-power question and which must be taken into account if hydroelectric development is to be encouraged and stimulated, with a corresponding effect on the development of the great electrochemical and similar industries which are essential to the industrial independence of the nation.

At the present time Congress is considering the enactment of legislation intended to remove some of the legal obstructions which in the past have operated to deter capital from investment in hydroelectric enterprises, and it would therefore seem to be a peculiarly opportune moment for the institute to be of service. As will be noted from the program which follows, it has been sought to correlate several of those phases of hydroelectric development which are of peculiar and perhaps unusual importance at the present time, while the standing of the authors who have consented to prepare papers insures adequate presentation.

The program for this meeting, as at present arranged, is as follows: (1) Address by President John J. Carty; (2) "Electrochemical Industries and Their Interest in the Development of Water Power," by Lawrence Addicks; (3) "Water Power Development and the Food Problem," by Allerton S. Cushman; (4) "The Relation of Water Power to Increased Transportation," by L. B. Stillwell; (5) "The Relation of Water Power to the National Defense," by W. R. Whitney; (6) "The Water Power Situation, Including Its Financial Aspects," by Gano Dunn.

Artists to Compete in Creating Design for America's Electrical Week.

Electricity the unseen force, appropriately symbolized in picture as the pre-eminent power of today, is to be the theme of designs submitted in a poster competition which has been instituted by the Society for Electrical Development to secure an appropriate emblem for "America's Electrical Week," the nation-wide trade movement to be conducted this year by the united electrical interests from December 2 to 9.

The contest opened April 1 and will close June 1. Two thousand dollars in prizes are offered.

The design is to be reproduced upon posters, in press advertisements, in circulars, booklets, folders, on stamps and posterettes. It is the intention of the society to give as wide a circulation to the design as possible, in order that the Week and its purpose may be properly brought to the attention of the nation as a whole.

The popularity of the "Goddess Electra" design of the "Electrical Prosperity Week" celebration of last fall demonstrates the effectiveness of using an emblem for a widespread movement of this kind. The Electra emblem was reproduced hundreds of thousands of times and was highly instrumental in making the celebration the enormous success that it was. The design was not only used in connection with booklets, folders, posters and special literature, but was printed with hundreds of newspaper advertisements throughout the length and breadth of the country. In many instances, the papers devoted an entire page to it.

In "America's Electrical Week" it is planned to surpass the celebration of last fall in every particular. When the "Electrical Prosperity Week" campaign was launched, there existed in some quarters uncertainty over the outcome. There has never been a precedent of its kind, hence the boosters of the movement had little except initiative with which to work. The Week, in spite of skepticism, scored a big success and established a well-grounded prestige for national trade campaigns.

The prizes offered in the coming poster competition are as follows: *A* $1,000 Grand Prize, *B* $300 Second Prize, *C* $300 Public Choice Prize, *D* $200 Art Students' Prize, and *E* $200 School Prizes.

All artists, designers, instructors and persons engaged in

the profession of graphic arts are eligible for the Grand, Second and Public Choice Prizes, provided they comply with the conditions of the competition.

The Art Students' Prize is open to students regularly attending any school of design, art academy or institution where poster art is a subject of instruction.

All designs entered for the Art Students' Prize will also be eligible for the Grand Prize, Second Prize and Public Choice Prize.

The School Prizes are divided into the following prizes: $1,00 for the first prize; $50 for the second prize; $25 for the third prize; $15 for the fourth prize and $10 for the fifth prize. These are open to pupils of high schools, public schools, private schools, parochial schools, seminaries or academies or to any pupil regularly attending any institution of learning which includes in its courses the art of drawing or design in any of its branches.

Certain conditions, rules and requirements must be complied with by all competitors. A copy of these may be secured from the Society for Electrical Development.

The judges who will decide upon the merits of the various designs and award the prizes as follows: John Quincy Adams, secretary, Municipal Art Commissions; Arthur W. Wiener, president, International Art Service; James P. Haney, art director of New York High Schools; Herbert F. Houston, president, Associated Advertising Clubs of the World; P. L. Thomson, advertising manager, Western Electric Company; Henry L. Doherty, president, Society for Electrical Development.

The committee in executive charge of the competition is as follows: Frank H. Gale, General Electric Company; J. C. McQuiston, Westinghouse Electric & Manufacturing Company; E. W. Rockafellow, Western Electric Company; George Williams, Henry L. Doherty & Company; Executive Staff, Society for Electrical Development, Inc.

Convention Program of the Northwest Electric Light and Power Association.

The ninth annual convention of the Northwest Electric Light and Power Association will be held in Seattle, Wash., September 6 to 9, inclusive.

The program committee has submitted a report which shows the following assignments of topics for papers to be presented at the convention: "Application of Overhead Line Construction Rules of the Public Service Commission of the Northwest," assigned to the Puget Sound Traction, Light & Power Company, Seattle, Wash., H. T. Crawford selected as editor. "Effect of Obsolescence of Equipment on Cost of Service," assigned to Portland (Ore.) Railway Light & Power Company, Leslie Craven suggested as editor. "The Employer as an Educator of the Public," assigned to the Wenatchee Valley Gas & Electric Company, Wenatchee, Wash., Arthur Gunn suggested as editor. "Merchandising and Operating in Small Towns and Rural Communities," assigned to the Pacific Power & Light Company, Portland, Ore. "Co-operation Between Central Stations, Manufacturers, Jobbers, Contractors and Dealers," assigned to the Pacific States Electric Company, San Francisco, Cal., W. L. Goodwin selected as editor. The Round Table Conference will be conducted by E. G. Robinson, president of the Association, who plans to mail a circular letter to all member companies, requesting them to submit subjects of general interest to be discussed at the conference.

The program is considerably shorter than those of former years, it being the intention of the Association to devote more time to discussions. With this in mind, abstracts of the papers will be in the hands of the members prior to the convention dates so that attending delegates can be prepared to discuss the papers.

The Pacific Coast Branch of the American Institute of Electrical Engineers will hold its convention on September 5, 6, 7 and 8, with a morning and afternoon session on the first day, and morning and evening session on the second day, and an executive session on the afternoon of Friday, September 8, thus giving an opportunity to A. I. E. E. members to attend the important sessions of the Northwest Electric Light & Power Association on the afternoon of Wednesday and Thursday, September 6 and 7. The Range Committee report will be discussed Thursday afternoon. Friday evening the annual banquet will take place, which will be a joint affair of both associations.

Electrical Exports for January.

The monthly summary of the foreign commerce of the United States for January, just issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C., shows that the electrical exports for that month were surpassed in recent months only by the record shipments in November. In the four electrical classes for which the numbers of articles exported are given in the government report, there were shipped in January the following: Electric fans, 1,433; arc lamps, 154; carbon-filament lamps, 128,522; metal-filament lamps, 507,527.

The detailed figures for last January and for the corresponding month in 1915 are given below:

Articles	Jan., 1916	Jan., 1915
Batteries	$ 115,354	$ 100,946
Dynamos or generators	56,983	309,868
Fans	16,010	17,221
Insulated wire and cable	265,622	83,728
Interior wiring supplies, etc. (including fixtures)	87,611	72,104
Lamps—		
Arc	1,203	759
Carbon-filament	14,667	5,802
Metal-filament	109,720	38,504
Meters and other measuring instruments	75,352	40,556
Motors	389,380	205,140
Telegraph instruments (including wireless apparatus)	5,802	17,326
Telephones	69,050	184,556
Transformers	55,708	57,122
All other	1,058,360	640,306
Total	$2,320,822	$1,773,938

Electric locomotives are separately listed in the report. In January eight of these, valued at $151,245, were exported.

Boston Street-Lighting Contract to Be Arbitrated.

Consideration of the Boston street-lighting contract with the Edison Electric Illuminating Company may be taken up April 17 by the Massachusetts Gas and Electric Light Commission. Professor H. E. Clifford has been investigating the question of rate, for the city, during several months past. A large volume of data on plant and operating costs has been compiled, which will be used in deciding the case. The Edison company claims an investment of $637 per arc lamp.

At a hearing March 30, John A. Sullivan, Boston city counsel, held that it is the company's duty to prove that its proposed rates are fair. He held that if the company is allowed to put in its exhibits as prima facie evidence, the Commission will lose control of the case and be obliged to endorse the published schedule.

F. M. Ives, for the Edison company, contended that the burden of proof is not on the company. It will, however, show how it bases its rates, and to this end has furnished Professor Clifford all data. If the city's expert is to formulate conclusions on a different basis, the company will wish to suspend the case and examine his figures. Chairman Weed held that it was not necessary to determine in advance what is a prima facie case, nor discuss burden of proof. The latter relates to an issue of facts, and the Commission would still be bound to investigate for itself and determine what is a fair price, assisted by everything presented by both parties.

Fire in East Nashville Causes Loss to Utility Companies.

Both the Cumberland Telephone & Telegraph Company and the Nashville Railway & Light Company were affected to a large extent by the fire that devastated a large area in the section of Nashville, Tenn., known as East Nashville, on March 22. The two utility companies suffered loss of several miles of lines and were both forced to make extensive repairs under pressure.

Every available employee of the telephone company was placed in service calling up business concerns for trucks and delivery wagons to be used in removing the furniture of residents in the path of the flames, this prompt action saving thousands of dollars worth of property. The number of telephone calls developed by the fire increased the switchboard load to three times the normal for a period of four hours, in which every operator on the list was on duty.

The heaviest line loss was that of a quarter of a mile of cable on the telephone toll lines to Louisville and Chicago, while several miles of open wire were melted down. The lighting company's loss was comparatively light, the greatest being the loss of customers. The first step taken by the company was cutting off of current to the eastern side of the Tennessee River, which separates East Nashville from the rest of the city. The mains to this section run under the river to manholes from which distributing wires serve various portions. By disconnecting lines at these points, the company was enabled to restore power to the industries on that side of the river which were out of danger.

About five miles of lines were down, while some of the street-railway feed lines were annealed so that they will require replacement as soon as this can be done. About 100 poles were burned down. New lines were strung on stubs and trees in order to restore lights to the sections beyond the fire area. Lighting current was flowing within a few hours after nightfall and only one street-car line was out of commission at that time.

A cordon of militia thrown around the burned zone prevented the stealing of the melted copper and enough of this was recovered by the company to reduce the loss materially.

Professional Men Work for Reconstruction of Belgian Arts and Industry.

Nevil Monroe Hopkins, as chairman of the Belgian Scholarship Committee, 309 Wilkins Building, Washington, D. C., is making an appeal to the professional and scientific men of the country for assistance in providing a fund for the reconstruction of Belgian educational facilities and opportunities for development in arts and science. The committee includes among its members the presidents or chancellors of the following universities: Johns Hopkins, Princeton, Michigan, Missouri, Leland Stanford, Pennsylvania, George Washington, State of New York, Nebraska, Rice Institute, Western Reserve, and many other leading men of the country, conspicuous among whom are Leo H. Baekeland, Thomas M. Chitard, Oscar T. Crosby, Harvey W. Wiley and Nathan C. Wyeth. It is proposed to establish a fellowship upon the basis of $1,000 a year for the duration of the war and two years thereafter, a sustaining membership of $100 and an associate membership of $10 each year under the same circumstances.

Oklahoma Association to Hold Annual Convention, May 23-25.

The fifteenth annual convention of the Gas, Electric and Street Railway Association of Oklahoma, will be held May 23-25 in Oklahoma City.

Among the papers to be presented are: "Safety-First Gas, Electric and Street Railway," by J. J. Johnson, Oklahoma City, to be accompanied by an exhibit by State Labor Commissioner Ashton; "Taxation of Public Service Corporations," by Prof. J. W. Scroogs, University of Oklahoma; "Development of New Business," by R. K. Johnston, Pauls Valley; "Diesel Oil Engines," by Prof. L. W. W. Morrow, University of Oklahoma; "Fuel Efficiency," by A. J. Neff, Abilene, Tex.; "Report of Rate Research Committee," by S. B. Irelan, Bartlesville; "Operation and Maintenance of Gas Distributing Systems," by J. F. Owens, of the H. M. Byllesby Company, and "Privately Owned Utilities and the Public," by W. R. Molinard, Oklahoma City.

H. V. Bozell, Norman, Okla., is secretary of the Association.

Ninth Annual Convention Banquet of the Minnesota Electrical Association.

The ninth annual convention of the Minnesota Electrical Association, held in Minneapolis, March 21-22, was one of the busiest and most successful meetings held by the Association, and was concluded by the annual banquet, at which there were covers laid for over 200 men of the electrical industry. The principal speaker of the evening was J. Adam Bede, former Congressman from Minnesota, who gave a rapid-fire talk, both serious and humorous, on the importance and progress of the application of electricity to industrial pursuits.

Miscellaneous NEWS NOTES

Portland Valuation to Be Completed.—The valuation of the properties of the Portland (Ore.) Railway, Light & Power Company, which the Public Service Commission started about two years ago, will be completed about April 25.

Draft Electric-Lighting Franchise.—The City Commission of Lexington, Ky., has authorized Mayor Rogers to enter into a contract with the Utilities Bureau, of Philadelphia, in connection with drafting of the proposed electric-lighting franchise which will be offered the Lexington Utilities Company.

High Temperatures in the Laboratory.—On March 15 the Faraday Society had an informal discussion in London, England, with demonstrations, on methods and appliances for the attainment of high temperatures in the laboratory. Sir Robert Hadfield, the well known steel manufacturer, was in the chair and Dr. J. A. Harker, of the National Physical Laboratory, took a prominent part in the discussion.

Institution of Electrical Engineers.—The third paper of the session on electric railway matters was read before this institution in London, England, in March. N. W. Storer, the author, dealt chiefly with the characteristics and possibilities of the direct-current motor for handling trains in the most economical and satisfactory manner, not only on one line but for interchanging equipments on lines where different conditions prevail.

New Lighting System for Cincinnati.—The Business Men's Club is advocating a plan for a comprehensive uniform ornamental lighting system for the entire business district of Cincinnati, O. Under this plan 234 arc lamps now used will be replaced with nearly three times that number of lamps, on ornamental standards, to be placed at proper intervals along the sidewalks. William O. Kleine, superintendent of street lighting, favors the plan, it is understood. The Sixth Street Business Men's Club has secured signatures of more than 90 per cent of the property owners on Sixth Street between Sycamore and Elm to a plan for the installation of an ornamental street lighting system, 14 lights to the square for the five squares, the lights to be 500-watt tungstens on ornamental iron posts, with opalescent globes.

Merger of New York Electric Companies Sought.—The Rochester (N. Y.) Railway & Light Company has applied to the Public Service Commission for an approval of a merger of the Canandaigua Gas Light Company, the Eastern Monroe Electric Light & Gas Company and the Dispatch Heat, Light & Power Company, through the purchase of the stock and property of these companies and for approval of the company's plans for taking over all but the railroad property of the Ontario Light & Traction Company. The petition states that all these properties can be acquired for $1,000,000 and permission is asked the Commission for the issuance of common stock in this amount.

Electric Show at New Orleans.—Plans for an electric show at the Hippodrome Building, New Orleans, La., April 24-28, are being made. Various spaces have been set aside for exhibition purposes for the electrical concerns of the city, and Tulane University has been invited to contribute an exhibit along the lines of electrical engineering. A miniature Niagara Falls will be shown in electric lights. The show will be under the general auspices of the New Orleans Jovian League, and W. E. Clement, secretary and treasurer, will have general charge of the arrangements. Others participating in the planning for the event are Colonel J. H. DeGrange, R. S. Stearnes, C. R. Churchill, P. G. Stern, C. S. Barnes, Fred Hannemann, and H. M. Muller, assistant secretary.

New York Jovian League Booming.—The Jovian League of New York held another boom lunch at the Hotel Imperial on Wednesday, March 29. The speaker was T. Commerford Martin, secretary of the National Electric Light Association, who delivered an inspiring address entitled "Electric Vistas and Outlooks." Arthur Williams, vice-president of the New York Edison Company, presided, and there were over 200 in attendance. At the meeting on April 4, Dr. Miller Reese Hutchison, chief engineer of the Edison Laboratories, was the principal speaker. Addresses were also made by J. R. Crouse, William Gloeckner, J. C. Forsyth and J. M. Wakeman.

Dallas Votes for Municipal Light Plant.—At the election held in Dallas, Tex., on April 4, the bond issue providing for establishment of a municipal lighting plant carried. The model franchise proposed by the city also carried.

Special Agent for South American Electrical Trade.—Stanley H. Rose, commercial agent in charge of the New York office of the Bureau of Foreign and Domestic Commerce, announces that Philip S. Smith has been appointed special agent of the bureau to investigate the markets for electrical goods in South America. Mr. Smith will report both on the present conditions as well as the future prospects in the South American market for electrical goods of all character. His reports will enable the American manufacturer to intelligently cultivate the South American market. At the present time Mr. Smith is visiting a number of American cities with the purpose of interviewing American manufacturers and to ascertain what ground American firms interested in foreign trade would like to have covered in the investigation. Mr. Smith proposes to be in New York City, Room 409, Custom House, from April 24 to April 27, and will be very glad to meet American manufacturers and exporters of electrical apparatus and supplies.

New Charging Station Booklet.—The New York Electric Vehicle Association has published a new electric automobile charging station booklet. It contains a complete list of all charging stations in New York City and within a radius of a hundred miles of the City Hall, together with the maximum amperage and voltage available, the hours during which service is available and the prices charged for boosting at all of the stations listed. There are two route maps, one of New York City and the other of suburban runs with the charging stations shown. There is an interesting and instructive chapter on auxiliary charging or "boosting," with a table of constant-current boosting rates. Perhaps the most notable feature of the booklet is the story it tells of the constantly decreasing price of electricity for battery charging. Year by year the trend has been constantly downward until at the present time the maximum rate of The New York Edison Company is five cents per kilowatt-hour, which tapers down to two cents per kilowatt-hour, according to the amount of current used. The electric garage established about a year ago by The New York Electric Vehicle Association, at Sixty-second and Central Park West, maintains passenger electric automobiles at a flat rate of $40 per month, including storing, cleaning, washing, polishing and charging with an unlimited amount of current. Typical garage rates in New York City for electric trucks range from $45 per month for a 1,000-pound car to $60 per month for a five-ton truck. This economic advantage is one of the strongest reasons why the future of the electric vehicle looks brighter than ever—particularly when it is considered that the cost of fuel for other types of motor trucks has advanced from 14 to 31 cents a gallon, with the prospect of going still higher.

The New Street-Lighting System of Milwaukee

Details of Lamp Fixtures, Circuit Layout, Illumination Characteristics and Cost Data

Part II

Lamp Fixture.

Through the adoption of the incandescent type of lamp as the standard unit, it was possible to design a special fixture of artistic pattern. This fixture, in two sizes, is substantially identical regardless of whether the lamp is mounted on bracket or harp posts or is suepended from a cable and, moreover, is exactly similar in external appearance whether it houses an electric lamp or a mantle gas burner. The exterior appearance has been shown in several of the illustration; Figs. 9 and 10 show the interior arrangement of an electric fixture.

It includes a number of new features on which patents assigned to the city of Milwaukee are pending. Liberal ventilation is provided by means of screened, and therefore bugproof, inlets and outlets of ample size. A special arrangement is provided by means of which the lamp socket can be vertically adjusted so as to change the character of the distribution. On lowering the socket the filament is brought deeper into the refractor and a more extended distribution (suitable for ratio M=8 or 12) is obtained; raising the socket in accordance with a definite gauge changes the distribution to make it correspond to M=6 or a still lower ratio. Thus the units are adapted to special requirements.

A close view of one of the refractor globes is shown in Fig. 11. These are of special Holophane construction used in the form shown in the Milwaukee installation for the first time; in the standard form they have been employed in numerous installations. They are duplex concentric globes with prisms on the inner sealed surfaces and smooth outer surfaces. For the tungsten lamps of 400 and 600 candlepower the modified standard eight-inch refractor is used. For all of the gas lamps and all electric units of 15 and 30-foot heights a special 11-inch size was developed for this installation. The refractor is firmly held in place by resting on a rigid ring just below the octagonal portion of the fixture. This part of the fixture can be swung down, permitting the refractor to be removed, if necessary, although as a rule it can be easily wiped out without even lifting it from its supporting ring. The glass panels in the octagonal portion can also be easily cleaned. These panels are illuminated and can have street names etched thereon, if desired.

Circuit Layout.

The idea carried out in the general design of the circuits was to provide a street-lighting system wired complete as to lamp circuits and subsidiary feeders and which could be supplied from the distribution system of the public utility company or that of the city, if the proposed municipal generating plant should ever be constructed. Thus the street-lighting system would be connected to the central-station lines through meters and service switches in the same way as the lighting system installed in the building of any private consumer. For this reason, and also to promote maximum economy and simplicity of operation, it was decided to eliminate entirely the special substation equipment usually provided for street-lighting circuits, such as constant-current transformers or regulators, rectifying apparatus, etc. The plan followed also eliminates the need for long special series mains connecting the local street-lighting circuits with the generating or substations of the central station.

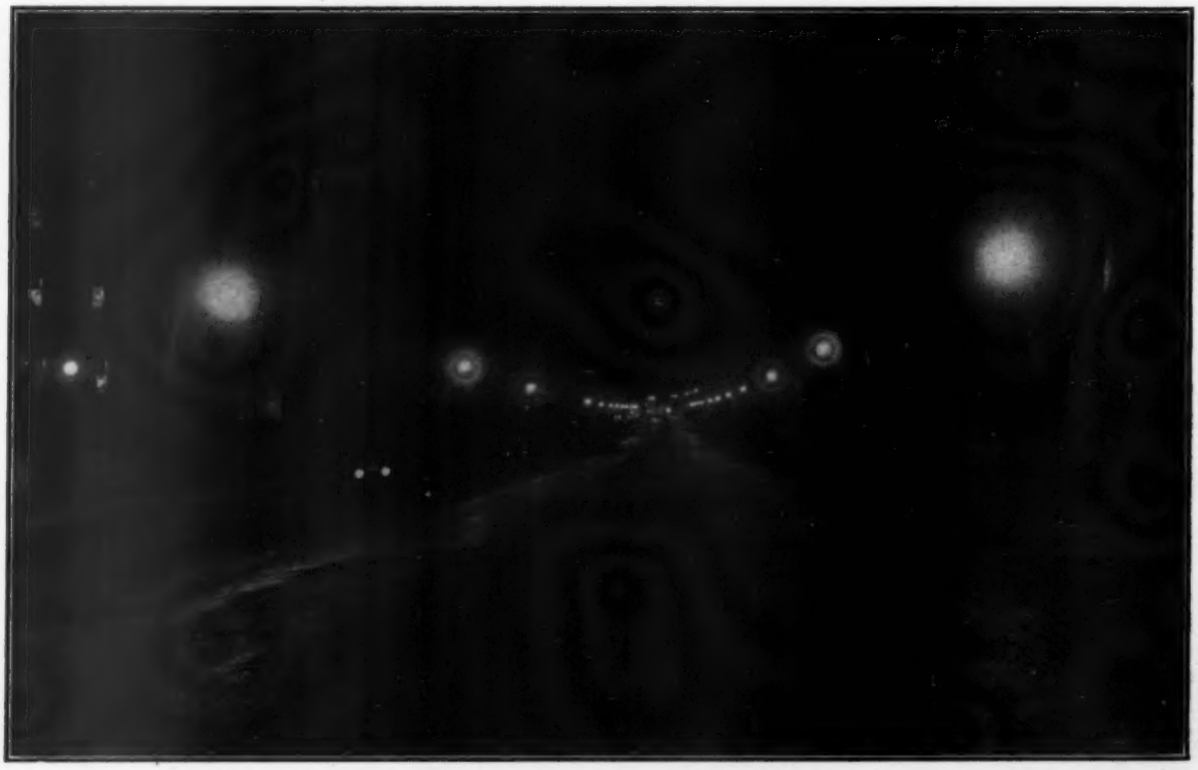


Fig. 7.—Night View of Upper Part of Grand Avenue.

At the points of connection of the lighting system to the central-station 2,300-volt primary lines, which are mostly overhead lines in the alleys, what amounts to a pole-type outdoor substation of a compact design is installed. This includes primary and secondary line lightning arresters; one-circuit transformer or a bank of transformers with taps on their secondaries to permit adjustment of the secondary voltage for varying numbers of lamps installed in the district; an electrically controlled pole-type oil switch for automatically cutting out the transformer in case of trouble and for turning on and off the lights in the district under the control of a time switch; there is also a meter for measuring the energy actually used and a recording voltmeter for checking the voltage regulation.

The oil switch is connected in the primary circuit of the transformer and therefore completely cuts it off, thus eliminating the core losses during the day; this switch also acts as automatic breaker and is connected to the time switch so as to avoid the need of having special operators or patrolmen for turning the circuit on and off. In the present installation a hand-wound time switch of the Anderson type is tentatively used. Electrically self-wound time switches will be used in the extensions of the system. Complete dependence is placed on time switches, since they have been developed to a very reliable state. The recording voltmeter and watt-hour meter are installed in a locked metal cabinet near the bottom of the pole which is conveniently arranged for meter reading without necessitating climbing the poles. The transformers used are usually of 15-kilowatt capacity and are so connected to ground that if one should be damaged or burned out it will not interfere with the others in the bank; thus while one of the secondary circuits might be affected, those connected to the other transformers will not be disturbed. A simplified circuit layout is shown in Fig. 14.

Fig. 8.—Night View of a Residence Street with 22.5-Foot Suspension Units at Intersections and 15-Foot Posts Intermediate.

From the secondary of the primary transformers is run a 6.6-ampere secondary circuit resembling the ordinary series lighting circuits in that it consists of a single wire loop run in a few cases on overhead poles, but for the most part (about 88 per cent of the complete system) as a single conductor of special armored construction buried about 15 inches below the surface under the sidewalk, or under the sod in the parkways directly back of the curbing, or under the pavements close to the curbing, no duct or conduit of any kind being used, except at street intersections where two-inch iron pipe was pushed under the pavement by pipe pushers and the cable pulled through this. It was not found to be economical or expedient to use any present underground conduits.

The buried cable, a view of a section of which is shown in Fig. 12, consists of the following layers: (1) jute covering; (2) two layers of saturated felt paper; (3) 0.035-inch steel tape; (4) 0.035-inch steel tape; (5) two layers of saturated felt paper; (6) 0.0625-inch lead sheath; (7) two layers of saturated cotton tape; (8) 0.0625-inch high-grade rubber insulation; (10) stranded No. 8 copper wire. The use of

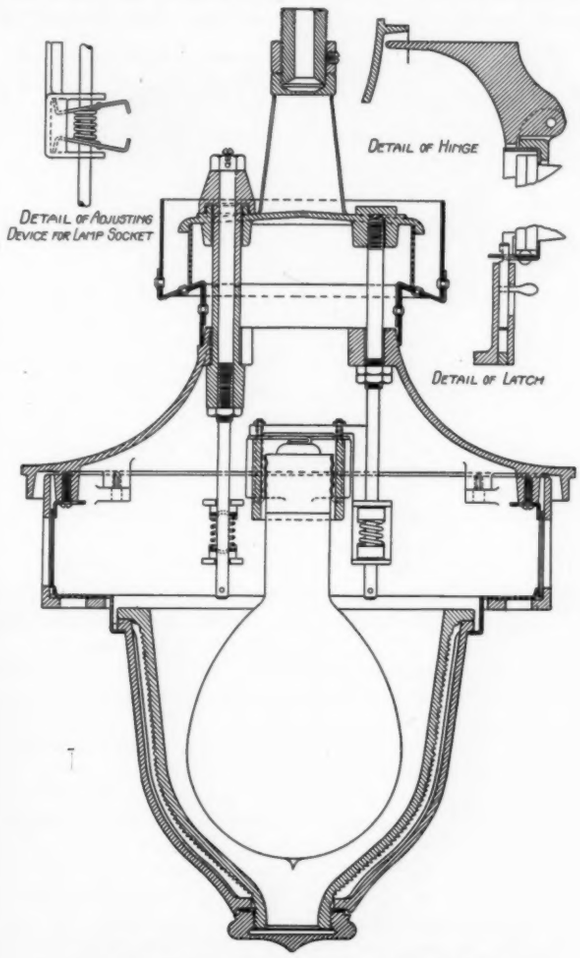


Fig. 9.—Sectional Elevation of Electric Fixture.

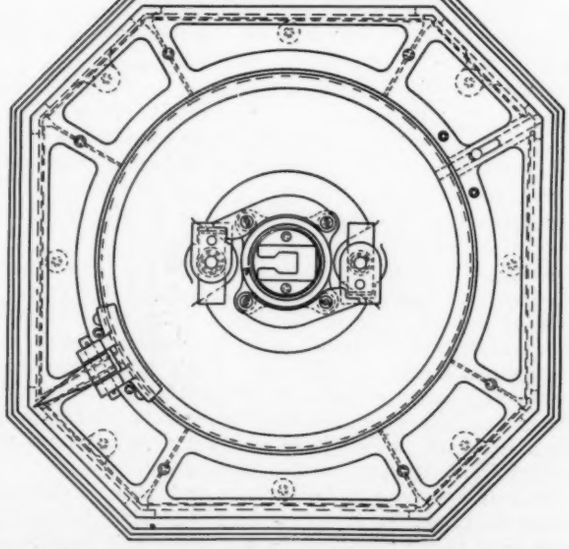


Fig. 10.—Bottom View of Fixture, without Refractor and Lamp.

felt paper (2) and (5) is an innovation in this country, although it has been used in Italy to minimize electrolysis of the armor and sheath.

Lamps are not connected directly into this secondary circuit, but are connected into individual lamp circuits by

Fig. 11.—Special 11-Inch Refractor Globe.

means of series transformers whose primaries are in the secondary circuit referred to. These transformers thus serve in place of the autotransformers or compensators frequently installed in connection with gas-filled lamps for street lighting; they are used in preference to the ordinary compensators because they insulate the lamp from high voltage. The transformers are buried on a layer of concrete at the base of the post and, after being connected in, are covered with sealing and waterproofing compound and with a layer of concrete for mechanical protection in case subsequent street excavation might be made. Fig. 13 shows the pit at the bottom of one of the posts just before the transformer was connected in. The transformer can be seen at the right of the picture. These transformers are of special Kuhlman construction; they are compact in size, inclosed in a steel case and are designed to withstand several times the maximum voltage that is likely to be impressed upon them. In the case of the larger lamps, these transformers step up the current in the lamp circuits to 20 amperes; for the smaller lamps the current transformation is 1 to 1.

A general idea of this entire layout can be seen from the simplified diagram of Fig. 14; this is not a diagram showing any particular circuit, but has been drawn simply to illustrate how the lighting units are connected to the lines. In the case of the small amount of overhead lines, the lamp transformers will probably be placed on the nearest poles.

No rigid or standard number of lamps has been adopted for any of the secondary circuits, this depending upon the size of the lamps to be installed on the different posts. The maximum load on any of these secondary circuits will be approximately 15 kilowatts, which might consist of 30 500-watt lamps or 150 of the 100-watt lamps or of various other numbers depending on the wattage of the lamps. In some cases two or three different sizes of lamps will be fed from the same circuit transformer.

In case any lamp is burned out or broken, it does not affect the remaining lamps on the circuit, since it is always connected to the circuit through a double-coil transformer. If the secondary of this is open-circuited, due to lamp failure, an almost negligible effect is produced on the current in the primary circuit because the transformer then acts as a reactance. This arrangement therefore eliminates the use of film cutouts and constant-current regulators. For double-bracket posts, the two lamps are connected to separate sections of the lamp transformer by means of a three-wire cable of which the middle wire acts as a common return; thus, if one of these lamps burns out, the other will continue to burn, which would not be the case were the two lamps connected directly in series across a two-wire secondary.

For testing the underground cables and equipment a number of testing stations are installed in each district; at the present time 12 of these have been equipped. These are neat iron pedestals with a locked door giving access to a test and cutout block of the Pemco type and a loop of the buried cable runs up to this. It is therefore possible to insert instruments and make any desired tests from these stations. In case of a ground, the point can be easily located because all lamps beyond the ground will be out. By means of a special testing set, such as a Telafault or one of the howler type, it is also very easy to trace faults in the cable, which lies only 15 inches below the surface and close to the curb. Troubles are not anticipated, however, because the cable is designed for 15,000 volts and will at no time be subjected to over 2,300 volts.

On some of the streets which are as yet unpaved and on which no definite grade has yet been established, the circuits will run as overhead lines from lamp to lamp and no underground construction will be used until the street is paved. In the outlying parts of the city this type of construction will be used and something like 12 per cent of the total system will be laid out in this manner. Even on these overhead circuits, however, the lamps will be connected to their lines through transformers.

The entire city was divided into 59 circuit areas, each comprising as compact and regular a district as local conditions would permit. The dividing lines between adjoining areas were usually placed on important streets, one side of these streets being fed from one circuit and the other side from the adjoining circuit. By this arrangement trouble on one circuit would not deprive these principal streets of all

Fig. 12. Sample of Cable.

Fig. 13.—View Showing Pit Along Base of Post Just Before Connecting in Transformer.

light. The circuit map of the city is shown in Fig. 15. The efficient and short routing of circuits permitted thereby is in marked contrast to that still in use in the old system.

Character of Illumination.

The accompanying night views, Figs. 7 and 8, give an inadequate idea of the excellence of the illumination pro-

duced on those streets where the full number of lamps has been installed according to complete schedule. The most distinguishing characteristic is the uniformity of the illumination, this being due chiefly to the general use of refractors which decrease the light directly below the lamps

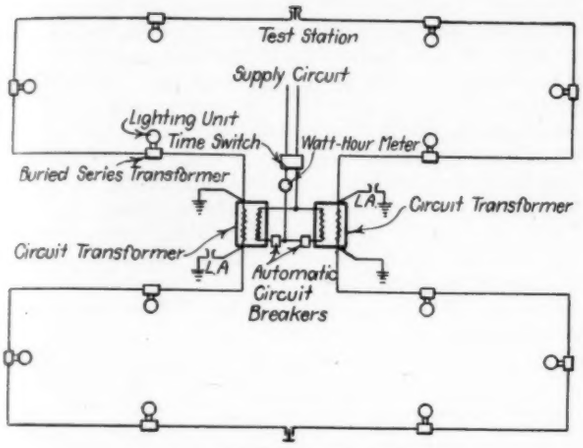


Fig. 14.—Simplified Circuit Diagram.

and increase that at points between adjoining lamps; this is also aided by high mounting of the lamps, which at the same time minimizes their glare and blinding effect.

On the principal street lighted (Grand Avenue) where there are four 30-foot posts, each with two 1,000-candlepower lamps, per block, the intensity of the illumination is about equivalent to 16 times that of the brightest moonlight. On less important business streets the illumination, though less intense, is also very uniform and this is true whether the light comes from post lamps at the curb or from center-suspended lamps. One street has post lamps arranged in the usual staggered order; its lighting is nearly as good as that of the streets where the standard order of posts directly opposite each other is followed, but the appearance of the latter arrangement is more pleasing. This is particularly noticeable on the narrower part of upper Grand Avenue, Fig. 7, where 15-foot posts face each other at intervals of 120 feet. The illustration shows how even slight irregularities in the street surface are made conspicuous.

On those streets where additional lamps are to be added in the future the lamps now in do not give as perfect uniformity as in the case of streets already fully equipped. The additions of the other lamps called for at intervening points will bring this uniformity up to the standard. On the less important residence streets it has been found that quite uniform and practically as good lighting on both sides of the street is obtained from a single row of lamps placed at one side only.

At those street intersections where the suspension unit is not used, one is at first surprised to find that the curb posts are not directly at the corners. However, the illumination at all parts of the crossing is entirely satisfactory. This is due to the fact that it comes from eight units, each located a little back of the corner. Four of these on the first street provide uniform illumination over its entire surface; the other four on the second street likewise uniformly illuminate its surface. The result is that at the entire crossing these two uniform illuminations overlap and there is practically twice as much light as along the interior of the block. In all cases throughout the demonstration installation the illumination is vastly superior to that formerly provided.

Scope of New System.

A good idea of the character of the different units proposed for the completed new system is gained from the following table:

Type of Unit	No. of Units
15 -foot harp post, electric	1,430
22.5-foot single-bracket post	1,924
22.5-foot double-bracket post	142
30 -foot single-bracket post	429
30 -foot double-bracket post	362
45 -foot double-bracket post	10
45 -foot four-bracket post	3
22.5-foot center suspension	2,499
15 -foot harp post, gas	2,022
Total	8,821

All of the foregoing, except the last, are electric units. The lamp equipment for these units is as follows:

	Candlepower of Lamp	No. of Lamps
Electric	100	1,015
Electric	250	881
Electric	400	3,328
Electric	600	1,359
Electric	1,000	739
Total electric	.....	7,322
Gas	100	2,022
Grand total lamps		9,344

A comparison on a candlepower basis of the old and new system shows that the 5,746 lamps of the old system aggregated to the amount of 956,580 candlepower, or an average of 167 candlepower per unit. The 8,821 units of the new system aggregate 3,409,550 candlepower, or an average of 387 candlepower per unit.

Installation, Operating and Maintenance Costs.

Although from the foregoing it is evident that the new system will provide over 3.5 times as much light as the old, its total annual cost will exceed the present figure by only 42 per cent. This relatively small increase is due to some extent to the fact that several square miles of territory in the outskirts of the city will be lighted that never before were lighted. The number of lighting units will be increased by over 53 per cent and the character of the illumination will be improved to an almost incalculable extent because all dark spots along the streets will be obliterated.

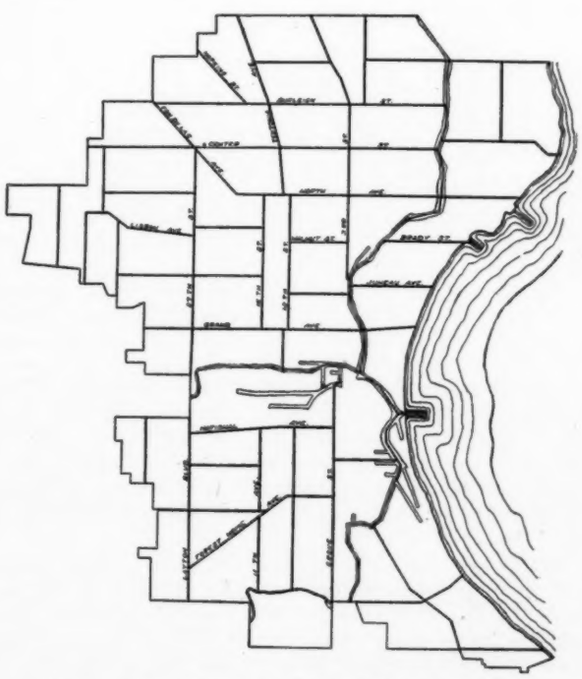


Fig. 15.—Map of City Showing the 59 Circuit Areas.

The inadequacy of the street illumination by the old system in Milwaukee was due not only to the inefficient equipment in use, but also to the meagerness of the amount annually expended for street lighting. Data on this matter

were obtained covering the year 1915 from the department of public works of each of the twelve other American cities having a population between 300,000 and 600,000 and compared with the expenditures of Milwaukee, as shown in the following table, in which the population figures are those of the United States Bureau of Census.

City	Population in 1915	Street-Lighting Cost in 1915 Total	Per Capita
Baltimore, Md.	584,605	$571,190	$0.98
Pittsburgh, Pa.	571,984	527,817	.92
Detroit, Mich.	554,717	361,349	.65
Los Angeles, Cal.	475,367	435,454	.92
Buffalo, N. Y.	461,335	497,190	1.08
San Francisco, Cal.	456,009	435,000	.95
Milwaukee, Wis.	428,062	232,910	.54
Cincinnati, O.	406,706	399,422	.98
Newark, N. J.	399,000	267,030	.67
New Orleans, La.	350,695	*278,363	*.79
Washington, D. C.	358,679	380,225	1.06
Minneapolis, Minn.	353,460	312,193	.88
Jersey City, N. J.	300,133	164,607	.55
Average			$0.84

*Figures for 1915 not obtainable; figures given are for 1912.

The foregoing figures include all energy and operating, maintenance and investment elements. This table shows that Milwaukee has been expending least for street lighting of all cities of its class. The total annual cost of the new complete system for Milwaukee will be $326,846, or $0.77 per capita, which is considerably lower than the average ($0.84) of all the 13 cities having populations between 300,000 and 600,000, as shown above.

A condensed summary of the installation cost of the completed system is given in the following table:

Quantity	Item		Cost
7,322	Electric lamps		$ 18,091
9,344	Lanterns or fixtures		159,705
8,821	Lamp supports—		
3,452	15-ft. posts	$114,779	
1,924	22.5-ft. single-bracket posts	72,612	
142	22.5-ft. double-bracket posts	5,697	
2,499	22.5-ft. suspension posts	184,926	
429	30-ft. single-bracket posts	22,531	
362	30-ft. double-bracket posts	19,910	
13	45-ft. bracket posts	1,581	
			422,036
6,799	Wiring lamp supports		43,234
2,022	Gas connections		18,076
6,802	Lamp transformers		95,122
456,011	ft. cable under pavement		200,108
1,137,709	ft. cable under parkway		311,358
211,285	ft. overhead lines		29,581
59	Sets circuit-control apparatus		32,585
	Total Installation Cost		$1,329,896

A more general division of this total cost shows it to consist of $668,754 for circuit lines and $661,142 for lamps and posts. The average investment cost of each of the 8,821 units of the complete system is $150.76; the average investment cost of the 6,799 electric units is $176.56. The decreased investment cost of the 2,022 gas units is offset by the greater energy and maintenance costs, as will be shown later.

It has been estimated that by using overhead construction on all lines outside of the downtown business district, a decrease in the initial investment of about $200,000 might have been produced. Likewise by use of rough wood poles, instead of concrete and steel posts, in all but the most important streets a further saving of about $200,000 might have resulted. This $400,000 would represent a saving in the annual cost of only 9 per cent, which is a very small amount to pay for the permanence and attractive appearance resulting from elimination of wood poles and practically all overhead lines.

All of the above estimated first costs are based on the prevailing prices of copper and other materials as of January 1, 1916. It is probable that some of the actual costs will fall below those conservatively figured. For example, concrete posts now cost about $1 per foot of length; it is believed this figure will be reduced by quantity production.

To raise the necessary funds to meet the installation cost it is proposed to issue municipal 20-year serial bonds bearing 4.5 per cent interest, at which rate they will probably sell at above par; one-twentieth of the issue will be retired each year. Allowing for the gradually decreasing interest payments as the bonds mature, the average annual interest charge per dollar of investment is $0.02365; the annual amortization charge to pay for one-twentieth of the investment is $0.05 per dollar invested; the total annual investment charges aggregate $0.07365 per dollar invested.

The total annual lighting cost is composed of three elements. The first is the energy cost for gas and electricity; the second is maintenance of lamps, posts, lines, etc.; the third is the so-called fixed charge or investment cost alluded to in the preceding paragraph. Gas is figured at $0.45 per 1,000 cubic feet. The type of gas burner used consumes four cubic feet per hour of burning, and the pilot flame used for lighting the lamp consumes one-third cubic foot per hour throughout the 24 hours of the day. Electricity is figured at one cent per kilowatt-hour. The total electrical energy is calculated as the lamp load plus 16 per cent thereof for line losses. All lamps, both gas and electric, are to burn on a 4,000-hour per year schedule. In the following table are given the annual energy costs of the different lamps to be used:

Item	Gas Lamps 100 C.P.	Electric Lamps 100 C.P.	250 C.P.	400 C.P.	600 C.P.	1,000 C.P.
Cost of energy consumed by lamp	$7.08	$2.83	$6.10	$9.63	$11.09	$17.55
Cost of energy lost in circuit	.....	.45	.98	1.54	1.78	2.80
Cost of energy consumed by pilot	1.31	.....	.....	.....	.....	.....
Total annual energy cost	$8.39	$3.28	$7.08	$11.17	$12.87	$20.35

In the maintenance items are included daily general inspections of all circuits and lamps to check outages, monthly cleaning of electric lamps, three lamp renewals per year, street and laboratory checking of candlepower maintenance and lamp quality, annual painting of steel poles, circuit and apparatus tests and repairs, etc. All electric lamps and circuits will be maintained by the city. Gas lamps, mantles and burners will be maintained by contract with either the gas company or the manufacturer, the Welsbach Company.

A good detailed analysis of all the annual operating costs of the different types and sizes of units is given in the table at the top of page 631. All but the first are electric lamps and units.

A summary analysis of the annual operating cost shows it to consist of $96,234.00 for energy, $132,697.58 for maintenance, and $97,914.42 for investment charges. A study of the annual-cost table shows that in each case the suspension units cost more than the corresponding concrete-post units. The cost of two-lamp or double-bracket units is also higher than that of more powerful single-bracket units; for example, a 30-foot post unit with two 250-candlepower lamps costs $53.49 annually, whereas a 30-foot post with a 600-candlepower lamp costs only $43.46. The improved appearance of double-bracket units warrants their use on the most important streets, however.

Another interesting fact disclosed by this table is that the use of a larger lamp adds but a relatively small amount to the annual cost of the unit; for example, a 250-candlepower lamp on a 30-foot post costs $32.21 annually, while a 400-candlepower lamp costs only $39.26, in other words, for an addition of $7.05 per year the illumination is increased by 60 per cent. This slight increased cost will be taken advantage of along those business streets where the merchants wish to provide a higher illumination than that scheduled in the completed plan. For instance, suppose the merchants wish to enhance the commercial importance of a street by increased lighting; instead of putting in cluster posts or other private posts at considerable expense, they may pay an annual charge of a few cents per front foot which will provide for the increased cost to the city of the larger lamps. It is contemplated (in fact, has already been done in the demonstration installation) to prohibit private lamp posts along the streets

DETAILS OF ANNUAL OPERATING COST.

No. of Units	No. and Candle-power of Lamps		Type of Unit	Annual Cost per Unit—Energy	Maintenance	Investment	Total	Total Annual Cost
2,022	1	100	15 -ft. Concrete post, gas	$ 8.29	$ 12.50	$ 4.71	$ 25.60	$ 51,763.20
1,015	1	100	15 -ft. Concrete post, electric	3.28	10.08	11.44	24.80	25,172.00
415	1	250	15 -ft. Concrete post, electric	7.08	11.88	11.54	30.50	12,657.50
266	1	250	22.5-ft. Suspension	7.08	11.88	14.33	33.29	8,855.14
50	1	250	22.5-ft. Concrete post, single bracket	7.08	11.88	11.29	30.25	1,512.50
32	1	250	30 -ft. Concrete post, single bracket	7.08	11.88	13.25	32.21	1,030.72
2,219	1	400	22.5-ft. Suspension	11.17	14.69	14.48	40.34	89,514.46
1,036	1	400	22.5-ft. Concrete post, single bracket	11.17	14.69	11.45	37.31	38,653.16
35	1	400	30 -ft. Concrete post, single bracket	11.17	14.69	13.40	39.26	1,374.10
59	2	250	30 -ft. Concrete post, double bracket	14.16	23.76	15.57	53.49	3,155.91
13	1	600	22.5-ft. Suspension	12.87	17.14	14.54	44.55	579.15
751	1	600	22.5-ft. Concrete post, single bracket	12.87	17.14	11.49	41.50	31,166.50
323	1	600	30 -ft. Concrete post, single bracket	12.87	17.14	13.45	43.46	14,037.58
13	2	400	30 -ft. Concrete post, double bracket	22.34	29.38	15.85	67.57	878.41
6	2	400	45 -ft. Concrete post, double bracket	22.34	29.38	21.04	72.76	436.56
1	1	1,000	Special suspension	20.35	19.68	14.66	54.69	54.69
87	1	1,000	22.5-ft. Concrete post, single bracket	20.35	19.68	11.63	51.66	4,494.42
39	1	1,000	30 -ft. Concrete post, single bracket	20.35	19.68	13.59	53.62	2,091.18
34	2	600	22.5-ft. Concrete post, double bracket	25.74	34.28	13.29	73.31	2,492.54
42	2	600	30 -ft. Concrete post, double bracket	25.74	34.28	15.94	75.96	3,190.32
4	2	600	45 -ft. Concrete post, double bracket	25.74	34.28	21.14	81.16	324.64
108	1 600 / 1 1,000		22.5-ft. Concrete post, double bracket	33.22	36.82	13.47	83.51	9,019.08
248	2	1,000	30 -ft. Concrete post, double bracket	40.70	39.36	16.16	96.22	23,862.56
1	4	600	45 -ft. Concrete post, four bracket	51.48	68.56	29.50	149.54	149.54
2	4	1,000	45 -ft. Concrete post, four bracket	81.40	78.72	29.95	190.07	380.14
8,821								$326,846.00

and those now in place will be removed. The idea is to adopt one municipal street-lighting system of harmonious design and character throughout the city and to concentrate all effort and expenditure on its development.

At the city election held on April 4, the voters of Milwaukee approved the issuance of bonds aggregating $750,000 to pay for the major part of the extension of the new system throughout the city. This insures having most of the work completed this year. The remainder will be finished in 1917 through an additional bond issue of about $500,000.

Advantages of Tie Lines Pointed Out.

At a recent hearing before the Gas and Electric Light Commissioners of Massachusetts, A. B. Tenney, of Charles H. Tenney & Company, Boston, exhibited a map which showed the territory north of Boston, in eastern Massachusetts, with the generating stations indicated, which included those in Lowell, Lawrence, Haverhill, Salem, Lynn, Chelsea, Malden, Revere and Boston.

The installed generating equipment in the territory, covering about 30 miles square, amounts to about 175,000 kilowatts, including the stations of the Bay State Street Railway Company. The maximum peak aggregates about 103,000 kilowatts, leaving 72,000 kilowatts surplus capacity.

It was pointed out that a greatly increased total capacity would result if all these plants were tied together, there being some 70,000 kilowatts in primary capacity, and 20,000 more of secondary power, in excess of the territory's demands for 12 months of the year, and some 20,000 kilowatts more for the 8 months, March to October inclusive.

The large margin above individual power requirements is due to the fact that the various plants are equipped to meet the maximum which occurs at varying seasons. For example, the generating station of the Suburban Gas & Electric Company, Revere, is taxed to its capacity during the summer months, when the important resort of Revere Beach draws heavily for light and power. On the other hand, the Malden Electric Company's station, supplying principally light to this well-to-do suburban residence district, has a much larger load during the winter.

It was brought out that an underground cable connects the plant of the Lynn Gas & Electric Company with the Suburban company's station. This passes under the Saugus River, and was installed a number of years ago for mutual protection. Lines of the Connecticut River Transmission Company are already installed as far east as nearly to Lowell, and it was pointed out that connection with the plants mentioned would give them the benefit of hydroelectric supply from the western part of Massachusetts.

Excellent Results Obtained in Electrical Operation of Panama Canal Locks.

At the meeting of the Western Society of Electrical Engineers held in Chicago on April 3, a paper entitled "The First Year's Operation of the Panama Canal Locks" was read by S. H. Grauten in the absence of the authors, F. C. Clark and R. H. Whitehead, respectively, superintendent and assistant superintendent of lock operation. In the first year of canal operation 1,370 vessels were locked through the canal without any accident whatever. The entire operation of the locks has been very satisfactory. The control apparatus has given excellent results and it was only by use of such a control system that so large a system of locks could be operated properly. Both up and down lockages are made at about twice the speed that was anticipated. Both lock operators and canal pilots were given very careful training. The night illumination of the locks has proven entirely satisfactory so that vessels can pass through the locks as freely at night as by day.

Electric locomotives used in towing and guiding vessels through the locks were designed for a speed of two miles per hour. It was feared this speed was too high when it came to handling very large vessels, so a scheme by which the locomotive speed could be reduced to one mile an hour was developed through concatenation of the motors. It has been found, however, that practically all vessels can be manipulated at the speed of two miles an hour without danger or trouble. Bids are now being sought on a number of additional towing locomotives in which certain improvements are to be incorporated.

The operation of the locks has produced some very interesting phenomena. Peculiar problems arose due to the difference in salinity on opposite sides of the lowest lock gates which produced difference of level and set up peculiar currents in the water. It has been found best to follow a definite cycle of operation in opening and closing the mitering gates and the various sets of valves. The salt water has been found to cause electrolytic corrosion in the steel where this is exposed to the action of the water in proximity of some other metal, such as bronze. No very large amount of metal is exposed in this manner and the potential difference between the metals is very low; however, since the action of this electrical couple goes on throughout the entire 24 hours, perceptible corrosion has been noticed when each lock chamber is unwatered and pumped completely dry for inspection, which is about once a year. Of the large number of paints and other coatings tried out to overcome this corrosion, bitumastic enamel paint has been found the most satisfactory.

Electrical Features of a Publishing Plant

New Installation at Establishment of the "Youth's Companion" Comprises a Comprehensive Motor and Control Equipment of Unusual Interest

Industrial Power Series—Article No. 160

About October 1 the famous publication, "The Youth's Companion," Boston, Mass., moved from its location on Columbus Avenue, in that city, to a newly constructed six-story reinforced concrete building in the Allston district. The presses, folders and other machinery employed in publishing were set up and electric motor drive applied individually to each machine. The earlier drive was by a steam plant, with line shaft, except for about 10 small direct-current motors operating small machines. Central-station power was decided upon for the newly installed plant, and a contract closed with the Edison Electric Illuminating Company for 220-volt, three-phase service.

The motor installation was placed in the hands of the Boston office of the Sprague Electric Works, of the General Electric Company.

The installation consists of about 100 Sprague motors, with an aggregate of 218 connected horsepower. All are on three-phase service except for job-press motors, which are single phase, giving a 3-1 speed variation. A 2-1 speed variation is typical for the three-phase service.

There are eight large rotary printing presses and eight flat-bed presses. Each of these machines is provided with a predetermined speed controller located on the nearby column which divides the pressroom into bays, in each of which one press is located. The controller, which is of recent Sprague production, carries the main switch and fuses for both the main driving motor and the small motor which operates the table, and the starting handle, which gives 16 different speeds from eight staggered contact buttons. This provides a range of 60 per cent variation between the fastest and the slowest speed.

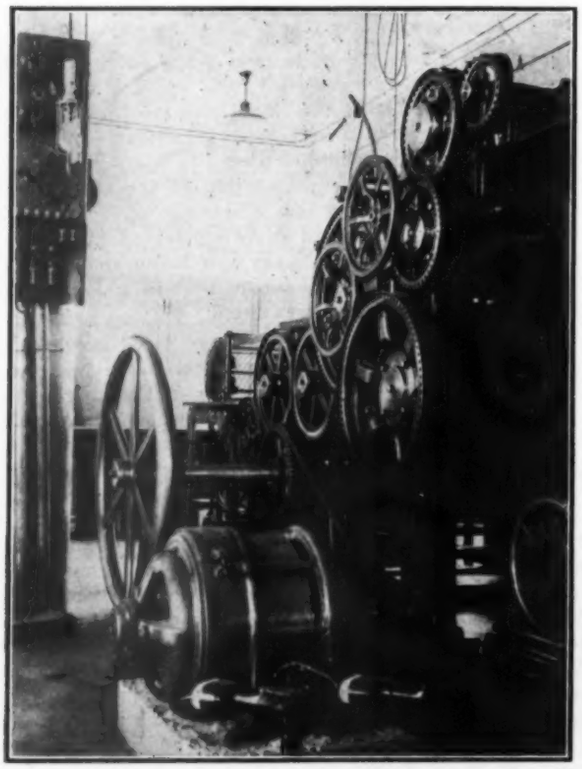
Motor-Driven Press Equipment.

In operating a press, the predetermined running speed is obtained by setting the handle on the proper point, and two push-button stations on the press, each with six buttons, give start, stop, jog, reverse, fast and slow motions.

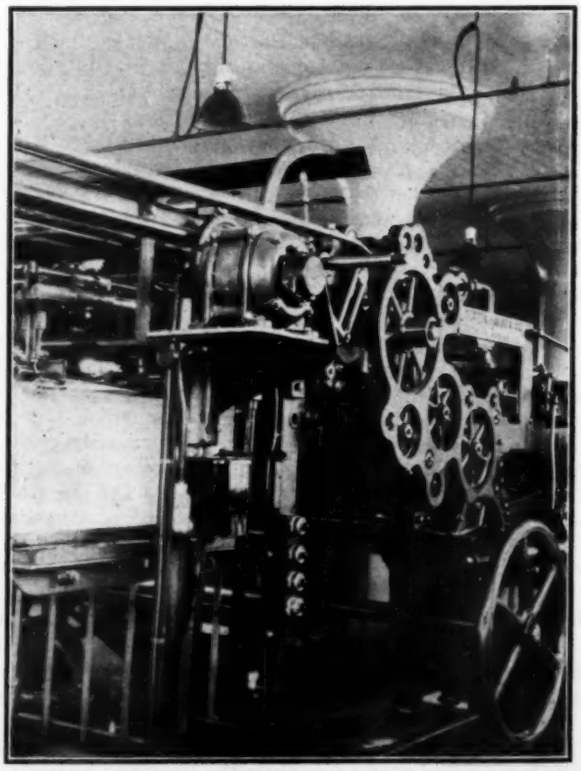
Motors driving the flat-bed presses are mounted on a special bracket attached to the frame under the step. Those driving the rotary presses are, in most instances, located directly on the floor, with conduit and condulets carrying the power loads vertically from the floor to the motor connections. In one or two instances a concrete base was cast for supporting the motors, on account of interference of the driving chain if located on the floor. The base is 24 by 36 inches and 5 inches high, and into it were cast two 26-inch sections of 6 by 6-inch Southern pine timbers. Lagscrews attach the motor bed to the timbers.

The eight rotary presses and four Dexter folders are connected to their respective motors by silent-chain drive, with sprockets on press and motor shafts. This type of drive was decided upon as giving a positive action, avoiding the slippage that smooth belts are subject to, and as being economical, obviating the necessity to relace and tighten ordinary belts.

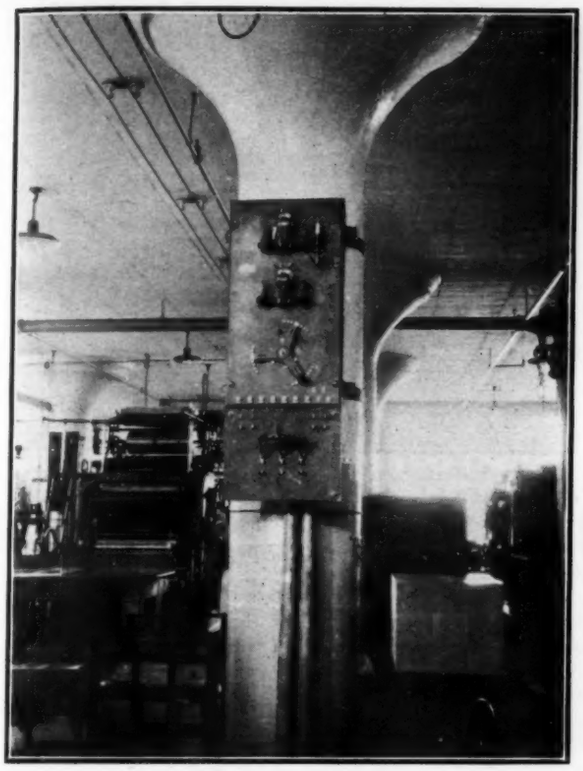
A feature of the motor application, on the folding machines, which provides for the lifting of the table, is a



A 10-Horsepower Three-Phase Motor Driving Rotary Press By Chain Drive, Youth's Companion Plant, Boston, Mass.



Method of Mounting Small Motor to Lift Table on Dexter Folders, Youth's Companion Plant.



Starting and Control Board for Motors Operating Presses and Folders, Youth's Companion Plant.

hanging bracket consisting of a 12 by 12-inch sheet-steel plate, for the motor to rest on, supported by hangers of strap steel about two inches wide and 12 inches long, bolted to the folder frame. The lifting apparatus was originally operated by means of a pulley belted from the line shaft. The motor now performing this duty is geared to the axle of the lifting apparatus.

On the four job presses referred to, the speed variations are obtained by the shifting of the brushes through a new foot-lever device; and this is clearly a more economical and efficient means than the wasteful method of putting the energy through resistance. The same lever starts the press by friction contact of belt or flywheel, after the motor has been brought up to speed. By this advanced device a 0.5-horsepower motor is adequate to drive a Golding jobber which otherwise would require one of much larger capacity.

Each of the large presses and folders is mounted on Southern pine scantlings about 2 by 6 inches, which extend under the whole length of the frame, giving the proper elasticity, on the concrete floors.

In re-furnishing the smaller machines, particularly those used in preparing electrotypes, the motors were in all cases mounted either on the frame or on the floor, in either case being encased in a removable corrugated iron hood, closely fitting over the motor and preventing the flying metal chips entering the mechanism. One of these machines, a flat-bed router, requires a speed of 12,000 revolutions per minute at the chisel. This is obtained from an 1,800 revolutions per minute vertical-shaft motor belted to the driving wheel of the router. A view of this motor is shown in one of the accompanying illustrations.

General Features.

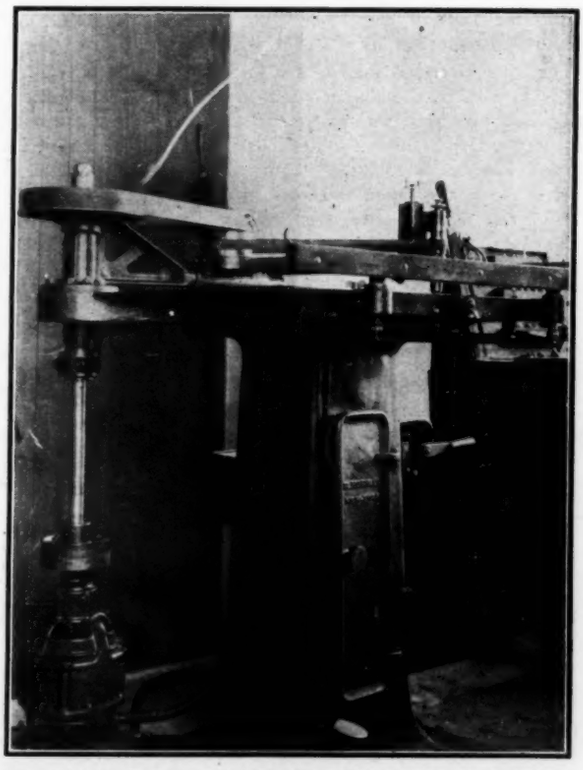
The building is served by three electric freight and one passenger elevator, all of A B See manufacture, and the lighting throughout the plant is by means of tungsten lamps, those in the offices being two-unit indirect bowl fixtures with 100-watt Mazdas, and those in the workrooms 50-watt tungstens on flexible cord with hook arrangements for suspension at convenient heights.

A complete list of the motors and the machines they operate follows:

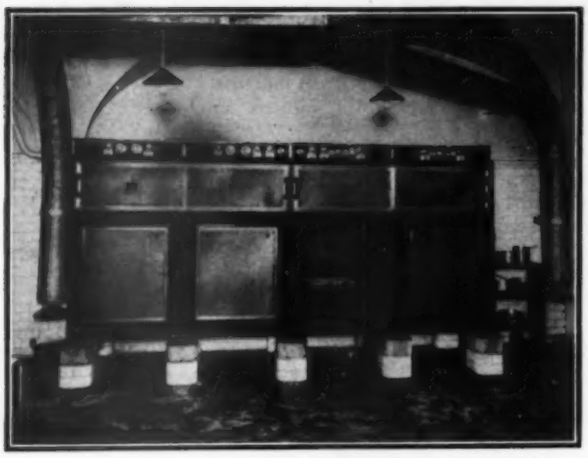
MOTOR INSTALLATION—YOUTH'S COMPANION PLANT, BOSTON, MASS.

No.	Horsepower.	Application.
1	0.5	One Unitype machine.
2	0.5	Two Golding job presses.
1	1	One Golding jobber.
1	0.5	One Harris rotary press.
4	7.5	Four Dexter folders.
3	0.75	Lifting tables on folders.
1	1	Rotary converter for bell system.
12	0.25	Monitor stitchers.
1	1	Monitor punch.
1	3	Acme cutter.
4	2	Acme cutters.
5	0.5	Chambers folder.
1	1/10	Numbering machine.
2	0.25	Pasting machines.
8	0.25	White addressers.
1	3	Acme cutter.
1	10	Autopress.
8	10	Cottrell rotary presses.
8	0.5	Lifting tables on above.
8	5	Cottrell flat-bed presses.
1	3	Cottrell flat-bed press.
6	1	Feeders for flat-bed presses.
1	1	Tympan winder.
1	0.5	Saw and drill.
1	1	Metal shaper.
1	0.5	Flat trimmer.
1	0.75	Beveler.
1	0.5	Router.
1	0.5	Channeller.
1	0.5	Newell press.
1	0.5	Roller washer.
1	0.5	Saw beveler.
1	1	Curved router.
2	1/25	Mail openers.
1	7.5	Machine shop—2 lathes, drill, shaper, metal planer and emery grinder.
1	3	Paper-cutter knife grinder.
1	5	Carpenter shop.
3	0.25	Envelope machines.
1	1	Blower on roof.

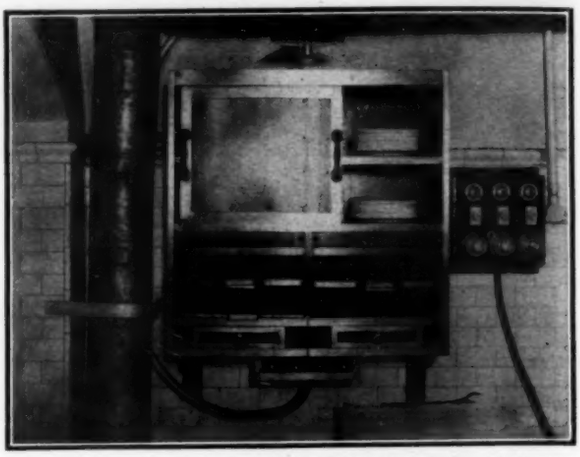
In the accompanying illustrations are shown a few of the more important motor applications at this plant.



Vertical-Shaft Motor Driving Flat-Bed Router at Youth's Companion Plant.



Electric Ovens and Hot Cupboard in Euston Station Restaurant.



Double Electric Grill and Hot Cupboard, Euston Station.

NOTABLE ELECTRIC COOKING INSTALLATION IN ENGLAND.

Restaurant of London & North Western Railway Finds Electric Equipment Admirably Suited to Requirements.

In the accompanying illustrations there is shown various features of electric cooking installation in the Euston Station, London, of the London & North Western Railway. There is wide scope in all big centers in England, as indeed everywhere where electricity is available for railway hotel and station installations of this kind. Every public restaurant run electrically is an attraction to diners and may be regarded as an excellent means for popularizing electrical service if only by reason of its ability to increase the satisfied consumer class who form so valuable an asset. Euston is of course one of the leading terminal stations of London and its dining hall is naturally patronized by throngs of customers at most times. The electrical equipment that has recently been installed is serving 400 meals per day, and Lieutenant Colonel Cortez-Leigh, the railway company's chief electrical engineer, has been responsible for it.

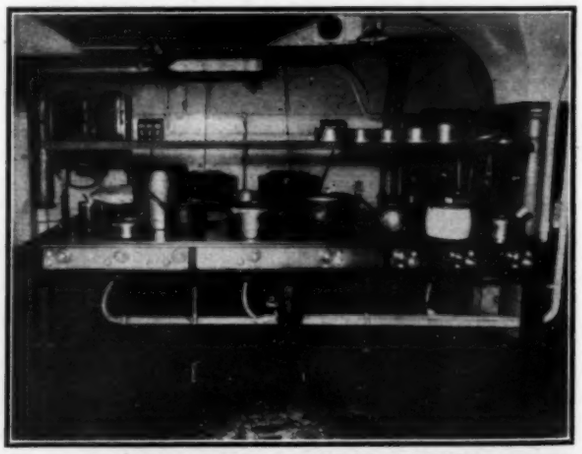
The total electrical load is 150 kilowatts and 90 covers can be dealt with in the dining room at one time. The railway company's own staff was responsible for the design of a number of the fittings used for the illumination of this hall. The electric kitchen is situated in the basement, and there are four ovens to the range as shown in one of the views. These ovens each measure two feet by two feet by two feet six inches high, with a warming oven above. The heating elements are of standard design. The total load of the range is 23 kilowatts, including 5 kilowatts per oven and 3 kilowatts for warmers. The switch and fuse panel is placed above, the seven heats being controlled through two three-way switches with pilot lights. The warming oven has the heating elements fitted at the back.

In connection with this installation there are two ham-boilers which are situated on the left of the above range. Together they take 7.5 kilowatts, and each boiler will hold eight hams, its capacity being 30 gallons; they are not exclusively ham-boilers as they are available for other classes of boiling duty as required. These boilers are fitted for three heats, and the heating elements are underneath, the switching devices being mounted on steel panels on the wall. The principal part of the equipment is the large boiling table shown in one of the illustrations. It has 23 hot plates, of 12, 10 and 8 inches diameter respectively. They are standard inclosed type, are fitted for three heats, and range from 1,200 to 1,500 watts. The switches, fuses, and pilot lights are placed round the frame as shown. On the wall there is a double grill and hot-cupboard. The grill elements are of nichrome wire spirals laid in grooves in a fireclay base, and the cupboard above derives its heat from these grill elements. There is a large hot-cupboard to take 1,000 plates, the heat being controlled from two single pole switches which together with fuses and pilot lamps, will be seen mounted below the top plate. There is also a six-compartment vegetable and pudding steamer, and a carving table, hot closet and vegetable server; this table is 11 feet 6 inches long by 3 feet wide.

All wiring in the restaurant and kitchen is carried in water-tight cast-iron channels and is arranged to be readily accessible.

The restaurant advertises the fact that all food served is prepared electrically and it is believed that an appreciable amount of business can be attributed to this advertising.

Electrically Heated Carving Table and Vegetable Server.



Large Electric Boiling Range at Euston Restaurant.

BOOK REVIEWS

"Elementary Lessons in Electricity and Magnetism." By Silvanus P. Thompson. Seventh edition, revised and enlarged. New York: The Macmillan Company. Cloth, 706 pages (5x 7¾ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc. for $1.50.

The seventh edition of this standard textbook of electricity and magnetism has been brought out and it possesses the same virtues as its long line of predecessors. The present edition has been revised and enlarged and forms a very suitable textbook for the student of the subject who has had enough mathematics to understand an algebraic equation. Chapters have been added relating to wireless telegraphy and to the modern conception of the electron. The printer has done an excellent job of mechanical work.

"Inventions and Patents." By Philip E. Edelman. New York: D. Van Nostrand Company. Cloth, 288 pages (5x8 inches), several illustrations. Supplied by the Electrical Review Publishing Company, Inc. for $1.50.

Written by a well known writer on wireless telegraphy, this volume covers an unusually wide range of the topics on which those interested in inventions should be better informed than is usually the case, being far more comprehensive than the numerous handbooks issued for free distribution (or sold at nominal prices) by the class of advertising patent attorneys who are severely scored in this volume. But like these same handbooks, Mr. Edelman's volume concerns itself largely with the speculative inventor, the man who expects to get rich quickly through patents on supposedly commercial and profitable inventions, rather than with the manufacturer or investor who looks upon a patent merely as the means for controlling profits on what has proven commercially profitable. Indeed, the author even says (p. 160): "Remember, the inventor's chief object should be to invent." This point of view is doubly unfortunate at a time when far too large a percentage of the issued patents are of the speculative variety, and in a volume which contains so much information of real value to those seeking protection through the Patent Office for actually established business ventures.

Moreover, many points of great importance are practically untouched. For example, design patents, in spite of their growing importance for manufacturers, are dismissed with brief statements about their being difficult to dispose of and about their requiring only brief specifications. Nothing is said about their running for different terms than the structural or process patents, or their requiring no final government fee. The fact that a shop right usually cannot be assigned, that even an "undivided" part interest gives the holder of the same the right to operate under the patent independently of those holding the other part interests, that an interference gives each party access to the other party's application papers—these and other extremely important points are left unexplained. So also, the language frequently is such that the average layman would not understand the same. To be sure, the author in his preface proclaims his book as intended for inventors, investors or manufacturers (adding, incidentally, that laymen might also find matter of interest), but judging from the reviewer's own practice, such parties all should be considered as laymen when addressed on subjects of this kind. To mention rules to them by number without stating where these rules are to be found, or to speak (page 77) of the rejecting of claims and the citing of references without explaining what is meant by "references" and by a rejection of claims on references, still leaves the reader in the dark as to these important points.

So also, some of the author's statements are seriously open to question, as when he reports it as good practice (page 114) "to file prints of the drawings at the time an application is filed", or states on page 61 that "the Patent Office is revising all issued patents." So also, a compliance with Mr. Edelman's recommendations as to avoiding all interferences would work great harm in many cases and certainly does not seem justified where the reader is decidedly earlier in his dates. The author's horror of interferences is shown by several pages enlarging on the possible expenses when the matter is contested to the last ditch, which rarely occurs in practice. No account is taken of the numerous instances where the mere showing of dates, involving only trifling expenses and formalities, results in a withdrawing of the contesting application. On the contrary, the inference from the chapter on Interferences would be that even the earlier applicant (if a reader of this volume) would drop out of the race as soon as an interference is declared, the impression being given in the last paragraph on page 150 that after doing so, he can effectively contest the patent issued to the other party! Such misleading statements are unfortunate in a volume addressed to laymen, and so also is the absence of advice as to methods of determining the commercial prospects of an invention, or in other words the patent-worthiness of the idea. Much space is devoted to criticisms of the Patent Office and of the methods of a certain small class of patent solicitors, and the author very properly advises a minimum expenditure of $10 for a preliminary search. Perhaps his likewise urging a minimum of $40 or $50 as the attorney's fee for filing and prosecuting a patent application would be even more beneficial in lessening the number of rejected applications and of unremunerative patents.

ALBERT SCHEIBLE.

"Engineering as a Career." A series of papers by eminent engineers, edited by F. H. Newell and C. E. Drayer. New York: D. Van Nostrand Company. Cloth, 214 pages (4¾x7½ inches). Supplied by Electrical Review Publishing Company, Inc. for $1.00.

This book presents for the guidance of youths and their advisers some of the facts usually hard to obtain concerning engineering as a life work. Over a score of engineers and experts prominent in the United States have written separate articles telling what they believe are the personal and educational qualifications required for success and what opportunities await the young man who chooses engineering as a career. The inspiration for the book came in response to numerous inquiries from high-school teachers and others who are frequently called upon to advise young men in their choice and preparation for a professional life. It was found from experience that many youths who planned to study engineering had only the most hazy ideas of what is involved, nor were their teachers and parents much better informed. A feeling of personal contact with the writers grows out of the fact that each author has unconsciously written into his story something of his own characteristics and aspirations, and has pointed out a few of the courses which to him have seemed to lead to success. The book should prove of special value to professional advisers in vocational guidance work and to parents who have the opportunity of continued observation and intimate acquaintance from which may be learned the aptitudes of their sons.

"The 'Mechanical World' Pocket Diary and Year Book for 1916." Manchester: Emmott & Company, Limited. Boards, 388 pages (3¾x6 inches), illustrated. Supplied by Electrical Review Publishing Company, Inc. for 25 cents.

The twenty-ninth year of publication finds some new features introduced into this useful collection of tables, data and engineering notes. The section on steam boilers has been improved by a discussion of boiler mountings, etc. A separate section is devoted to Diesel engines, and there is much material of value in the machine shop. There are a number of new tables and the book has been generally revised.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

POSTCARDS TO CUT DOWN THE DIRECT ADVERTISING COST.

Reduce Cost of Letters With Return Postal 22 Cents Per Prospect.

An interesting experiment which seeks a way to reduce the cost of direct advertising is being conducted in Louisville, Ky., by the Louisville Gas & Electric Company, through the commercial department, of which Robert Montgomery is manager.

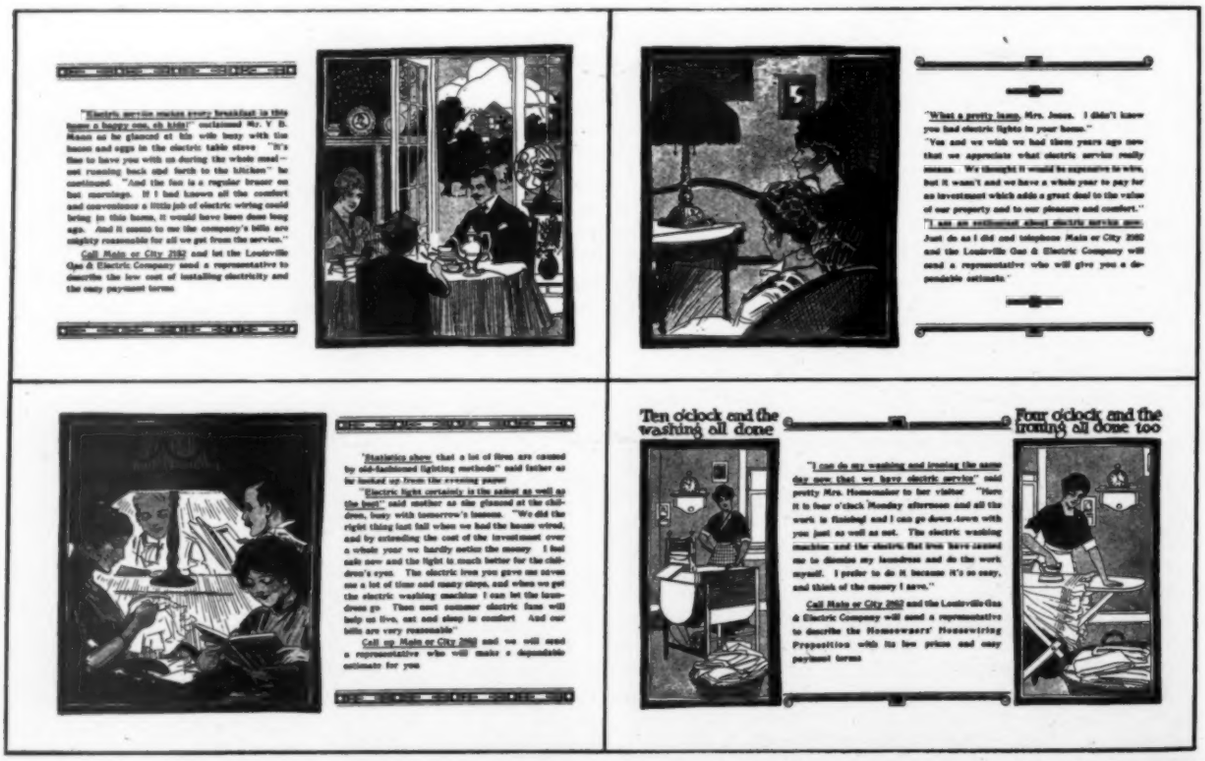
There are at this time about 9,000 houses, prospective house-wiring customers Mr. Montgomery calls them, within reach of the existing lines of the company. This number has been reduced week by week during the past several years from a figure twice as large, the company cooperating with the electrical contractors and, in addition, indulging liberally in advertising.

It has been a more or less frequent custom of the department to send out letters to house-wiring prospects, calling attention to special proposals or to one or another feature of electric lighting. These have contained as much matter as a two-cent stamp would carry, including a stamped, return post card. Booklets, calling attention to the electric-service advantages have been set before these prospects and others who have signed contracts in such a manner.

The returns have not been what the company liked to see, considering the cost of this method of circularizing. In the first place the total cost figures out as much as five cents, including the three cents for postage. Responses have averaged about five per cent, pretty good for the class of business, but obtained at rates Mr. Montgomery believed he could improve on. And in spite of the fact that the stamped return post card was inclosed in the envelopes in the several cases, only about half of the responses were by mail, the remainder being by telephone or by personal visit.

This suggests, at this point, the question whether for local circularization, at least in matters where responses cannot be expected to be heavy, it is not prohibitively expensive to inclose stamped post cards. That is one of the propositions Mr. Montgomery considered when he determined on the test he is now carrying out. In these days when telephones are to be found in general use, available to most householders if not actually installed in houses of prospective subscribers, such a ready means of communication is often preferred to even addressing of a post card. Take a series of 12,000 envelopes, for instance; the postage on the return cards alone would cost $120. If half of the five per cent of responses was by card this meant that this sum went largely for postage on 300 post cards, rather exorbitant postage.

These and other considerations set Mr. Montgomery to work on the post-card plan. After considerable thought


"Electric service makes pretty breakfast in this home a happy one, eh kids!" exclaimed Mr. Y. B. Mason as he glanced at his wife busy with the bacon and eggs in the electric table stove. "It's fine to have you with us during the whole meal—not running back and forth to the kitchen" he continued. "And the fan is a regular bracer on hot mornings. If I had known all the comfort and convenience a little job of electric wiring could bring to this home, it would have been done long ago. And it seems to me the company's bills are mighty reasonable for all we get from the service."
Call Main or City 2182 and let the Louisville Gas & Electric Company send a representative to describe the low cost of installing electricity and the easy payment terms
"What a pretty lamp, Mrs. Jones. I didn't know you had electric lights in your home."
"Yes and we wish we had them years ago now that we appreciate what electric service really means. We thought it would be expensive to wire, but it wasn't and we have a whole year to pay for an investment which adds a great deal to the value of our property and to our pleasure and comfort."
"I am an enthusiast about electric service now. Just do as I did and telephone Main or City 2182 and the Louisville Gas & Electric Company will send a representative who will give you a dependable estimate."
Statistics show that a lot of fires are caused by old-fashioned lighting methods" said father as he looked up from the evening paper
"Electric light certainly is the safest as well as the best" said mother as she glanced at the children, busy with tomorrow's lessons. "We did the right thing last fall when we had the house wired, and by extending the cost of the investment over a whole year we hardly notice the money. I feel safe now and the light is much better for the children's eyes. The electric iron you gave me saves me a lot of time and many steps, and when we get the electric washing machine I can let the housework go. Then next summer electric fans will help us live, eat and sleep in comfort. And our bills are very reasonable"
Call up Main or City 2182 and we will send a representative who will make a dependable estimate for you
Ten o'clock and the washing all done
Four o'clock and the ironing all done too
"I can do my washing and ironing the same day now that we have electric service" said pretty Mrs. Homemaker to her visitor. "Here it is four o'clock Monday afternoon and all the work is finished and I can go down town with you just as well as not. The electric washing machine and the electric flat iron have caused me to dismiss my laundress and do the work myself. I prefer to do it because it's so easy, and think of the money I save."
Call Main or City 2182 and the Louisville Gas & Electric Company will send a representative to describe the Homeowners' Housewiring Proposition with its low prices and easy payment terms

Four of a Series of Six Cards Mailed to Each House-Wiring Prospect by the Louisville Gas & Electric Company. These Cards Take the Place of Six Follow-Up Letters and Save the Company 22 Cents Per Prospect.

he decided on the text and the form of the illustrations for each of the cards and decided on a series of six. Drawings were made for him and the six sets of the series, 9,000 cards to a set, were struck off. The plan is to mail them out, one set every two weeks, to the 9,000 prospective customers on the company's list, until the series of six is used up. This will give intervals for responses and at the same time keep the idea from growing cool in the minds of those who have felt an impulse to ask for a definite proposition on receipt of earlier cards. Of course the responses will be checked against the original lists and no prospect will be snowed under with cards when he has already responded.

In preparing the plan for the series Mr. Montgomery undertook to present the case for electric lights in brief from several angles and to make the appeal to several different motives on the part of the recipient. Four of the cards are shown in the accompanying illustration. One presents the advantages and desirability of electric lighting in general; one is directed to the house owner and shows that there is small chance of renting houses without electric lights; one puts the emphasis on the beauty of electrical fixtures, another the ease with which a breakfast can be electrically prepared, a fifth the safety element in electric lights and the sixth the way electric service lightens housework.

The text is written in an easy conversational style, and the drawings are well executed. The breakfast scene really carries a punch and alone would be sufficient to prompt many a prospect to call the number which is given below the text, while the quality of the punch in the other pictures is also of a high order. The cards themselves measure 5 by 8.25 inches, and are printed on a white bristol board.

It is too soon, as yet, to consider whether the returns from this campaign will meet the expectations of Mr. Montgomery and his company. But the outstanding feature of the whole procedure is the low cost of the cards. This will not be more than eight cents for each set of six cards mailed out and should fall slightly under that amount.

"I anticipate," Mr. Montgomery stated, "that they will have triple the advertising value of one circular letter."

And compared with the cost of one appeal or reminder at a cost of five cents, six times at the prospect, in an attractive way, at the cost of eight cents is something very well worth getting.

Pittsfield Company Gains Aid of Customers.

The accompanying ad of the Pittsfield (Mass.) Electric Company shows how the company is securing the aid of its customers in the acquisition of new business by offering to reduce rates when the number of customers has reached a certain figure.

RATE REDUCTION
We now have 3,700 customers. When we serve
THREE HUNDRED more, we intend to reduce our Residence Lighting Rate
3,700 Wired Houses that look like this.
There are over 3,000 unwired houses in the city of Pittsfield. We want 10 per cent of these to be wired; co-operate with us to obtain this business and reduce the lighting rate.
The More Customers the more widely electricity is used, the cheaper the rate, other conditions remaining the same
3,000 Unwired houses, some of which look like this.
YOU
Who are using electric service. Help us get these 300 new customers by talking the advantages and quality of electric service in your home
NOTE THESE FACTS
January 1st, 1913—3,000 Customers—Rate reduced from 17c to 14.4c per K. W. H.
July 1st, 1913—3,000 Customers—Rate reduced from 14.4c to 13.5c per K. W. H.
January 1st, 1914—4,000 Customers—Rate reduced from 13.5c to 10.8c per K. W. H.
1915—4,000 Customers—We intend again to drop the Rate when this point is reached.
YOU
Who are NOT using electricity ask your friends who are. Then 'phone us to submit an estimate, and see how little investment is required to equip your home
Phone 947
Pittsfield Electric Co.
Phone 947

Advertisement That Is Gaining Co-operation of Customers.

New Hampshire Company Appeals to House Owners.

A potent appeal to landlords is contained in the accompanying advertisement of the Manchester (N. H.) Traction, Light & Power Company. Unwired houses are generally neglected nowadays by tenants of the desirable sort; at least, such houses are left as the last resort and rented, if at all, at low rates. By adding a small investment, in lighting, permanent tenants are readily secured. The ratio of this investment in installation may be scarcely one per cent of the value of the premises, and yet it may be the cause of making a paying proposition out of a non-revenue producer.

Houses Like These Are
NOT Profitable Investments
Almost the first question asked by the prospective tenant is, "Is your house wired for Electricity?"
Answer him with "No" and most likely the "For Rent" sign will remain on the house.
Whether you own an unwired house or are the tenant in one, you will be interested in our $15 House Wiring Proposition.
Ask Us About It Before April 15th.
Manchester Traction, Light & Power Co.
46 Hanover St. Tel. 492

How the Manchester Company Appeals to House Owners.

As noted in the issue of March 25, the Manchester company offers to wire for service, for a basic price of $15.

Boston Company Promotes Use of Tailors' Electric Irons.

The Edison Company of Boston has been making a special drive in introducing electrically-heated tailors' irons, or gooses, as they are called. About 2,000 tailors, both masters and journeymen, were circularized and during six weeks about 50 irons were placed. They call for a special circuit and are supplied on the low heating and cooking rate. The irons weigh 12 to 22 pounds and take 700 to 850 watts, according to size.

Their introduction in tailors shops has brought about an interesting situation, many journeymen now refusing to work except where electric irons are installed. They are in favor because of their greater comfort and healthiness, and piece workers are able to make more money than with the old type of goose.

Electrically Operated Advertising Signs on Horse-Drawn Vehicles.

A novel method of advertising Crystal Domino sugar is employed by the American Sugar Refining Company of New York at its Brooklyn (N. Y.) plant.

Horse-Drawn Vehicle Equipped With Electric Sign Operated From Storage Battery.

All of its horse trucks are being equipped with electrically driven advertising signs. Fifty are already in operation and 25 more will soon be placed in service. The low cost in maintenance of this publicity is quite remarkable when one considers the extent of the local territory so thoroughly covered by these signs.

There are three types of signs, viz.: One advertising Crystal Domino granulated sugar. This one is furnished with a revolving disk illustrating the flowing of Crystal Domino granulated sugar from the carton to the bowl.

The second mechanical sign shows "Little Miss Crystal Domino" emptying a carton of crystal Domino sugar tablets into a sugar bowl. This sign is furnished with a revolving disk having colored stripes painted spirally thereon. When revolving the disk gives the effect of a rotating rainbow. This rainbow effect is seen through the lettering on the edge of the disk, namely, through the wording, "The American Sugar Refining Co. of N. Y.—Crystal Domino Sugar."

The third mechanical sign advertises both the Crystal Domino tablet sugar and Crystal Domino granulated sugar alternately; by an ingenious mechanism the picture of Crystal Domino cartons and tablet sugar appear, and, by passing a vertical lath over the face of the picture mechanically, the picture disappears as if wiped out, and in its place cartons of Crystal Domino granulated sugar appear. This latter picture, after the lath has made the full stroke or length of the picture, reverses automatically, and in turn is wiped out. All of the sign moving mechanism is driven by a six-volt, ball-bearing motor, taking 10 amperes and running 1,000 revolutions per minute. A six-volt, 120-ampere-hour Exide battery manufactured by the Electric Storage Battery Company, of Philadelphia, Pa., supplies the energy for running the motor.

As the batteries have only sufficient capacity for one day's service, it is necessary to recharge them each night. Polarity plugs are used to connect the battery to sign, or to the charging receptacle. Twelve batteries are charged in series across 115-volt mains. The batteries, when removed from the trucks, are placed on a double-deck platform, six on top and six on the bottom. A hand-drawn elevating platform truck is used to raise the load and convey the batteries from the wagons to the charging stand. Six sets of 12 charging receptacles are provided, allowing 72 batteries to be charged at one time. The batteries are charged all night and are replaced in the trucks each morning, ready for service.

Four men are employed maintaining the operation of the signs, two on day and two on night. They make all necessary repairs to moving mechanism, motors, storage batteries and wiring, and systematically clean and overhaul each sign.

New Street-Lighting Contract for Milford.

The town of Milford, Mass., has voted adversely on a project to acquire a municipal light plant, and has decided to contract with the Milford Electric Light & Power Company for four years for incandescent street light in place of the present gasoline street lamps and 17 arcs. The rates offered by the company are:

32-candlepower incandescents	$18 per year
40-candlepower nitrogen-filled	19 yer year
60-candlepower nitrogen-filled	20 per year
80-candlepower nitrogen-filled	24 per year
250-candlepower nitrogen-filled	36 per year

Lamps to be installed by the company and to burn on an all-night schedule.

Training Electrical Housewives of the Future.

So that the housewives of tomorrow will have a clear knowledge and understanding of the various and important uses of electricity in the modern household, the Domestic Science Department of the Washington Irving High School, New York City, maintains a thorough course in electric household appliances. The Washington Irving High School is the largest and most completely equipped girls' high school in the world. There are 800 girls enrolled in the Domestic Science Department, of which Miss Florence Willard is the head. Among other electric appliances which were installed under the supervision of the Heating Bureau of the New York Edison Company are more than 20 electric flat irons, electrical percolators, chafing dishes, tea kettles, toasters and grills.

Among some women there existed a strange and unfounded fear of anything electrical. Some women actually shrank from touching anything electrical for fear of a shock. It is the plan of Edward C. Zabriskie, principal

This Domestic Science School is Completely Equipped With Electrical Devices. View Shows 20 Electric Irons in Use.

of the Washington Irving High School, by means of this course in the domestic uses of electricity to dispel forever these false and ridiculous notions from the minds of the future generations of housekeepers and teach them that electricity is their friend and servant.

POWER ENGINEERING

Problems Involving Motor Applications, Machine Characteristics, Power Sales Methods and Industrial Electric Heating

Electric Power Economies in a Small Factory.

Upon careful analysis, the advantages of electric motor driving in a small factory are often found to be highly significant. In a representative installation producing belts, a power survey indicated an average load of 11.3 indicated horsepower; the average power and lighting load was 16 horsepower; the maximum power requirements with mechanical drive were 14.6 horsepower, and the maximum power and lighting load was 20 horsepower. The friction load was two-thirds of the average power load.

Running 58 hours per week, the cost of operation with mechanical drive was found to be $909 per year, the items being coal, $717; water, $52; ash removal, $40; oil and supplies, $50; electricity for lighting, $50. Considering the installation of one 7.5-horsepower and two 5-horsepower motors, it was found by the local central station that 5 horsepower net could be eliminated from the factory demands. This reduces the average power load to 6.3 horsepower and the maximum to 9.6 horsepower. There are 65,000 cubic feet of building space to be heated. The estimated yearly cost of operation with central-station service was $803; the detailed items being, coal, 35 tons, $175; water, $25; ash removal, insignificant expense; oil and supplies, $15; energy for power service, $492; energy for lighting, $96.

The estimated saving yearly, including an allowance for a reduction in boiler and fireroom labor, totals $206. The cost of installing the motors was found to be $450, and improved speed regulation was also promised with electric service, the existing speed varying 22 per cent.

Electric Furnace in Milwaukee Effects Economies.

For the past two years the Crucible Steel Casting Company, Milwaukee, Wis., has been operating a Snyder electric steel furnace and the company reports that during this time decided economies have been effected over previous operation. Except for charging and pouring, the furnace requires the attention of only one man, who receives $2.50 per day. The energy consumption is approximately 500 kilowatt-hours per ton of steel produced.

The furnace is rated at one-ton holding capacity. The foundry operates 12 hours per day and in that time the furnace gives four heats with an average of 3,200 pounds per heat.

As to maintenance cost, it is stated by the Crucible Steel Casting Company, that the present roof has lasted 500 heats and is expected to give 200 to 300 heats more. The linings need replacing only once every 215 heats, and complete relinings can be effected between Friday and Monday, when the furnace is not ordinarily in operation. An average of 3 to 3.5 pounds of electrodes are consumed per ton of steel.

Economies of Electrically Heated Shoe Machines.

The average cost of repairing and dressing up defects in patent leather shoes made by a Massachusetts shoe concern has been cut down more than 50 per cent since the installation of electrically heated turners' irons, made by the Boston Last Company on Simplex patents. The cost was formerly 2.5 cents per pair, based on accurate figures, but with the new equipment it has been reduced to 1.12 cents, representing for the 1,000 pairs of shoes produced daily, a saving of about $4,000 a year.

Another shoe manufacturer using 90 turners' irons finds that a great saving has resulted by a year's use of this equipment, in that now there are no burned shoes, whereas formerly much damage was done by gas irons used, which took off the enamel because too hot.

Advantages of the electrically heated wax pot are the evenness of heat which makes possible an even application of wax to the surface of the heel, and the saving in wax and in the operators' time.

The electric-heated shank burnisher is another efficient tool. This is maintained at any required heat by rheostat control, and is always ready for instant and efficient use without the operator being obliged to watch an oil or gas stove for fear of overheating the iron. When these irons are heated over a stove, the operator is obliged to rub the iron on a pad to remove the soot and smoke. The electric iron is always clean, insuring freedom from danger of soiling or defacing shoe bottoms.

Model Shoe Factory at Salem, Mass.

What is regarded as the "last word" in shoe-shop equipment is that of Daniel Glover & Sons, Salem, Mass., makers of youths' and boys' shoes. The four-story brick building just completed houses a plant capable of producing 2,000 pairs per day.

The factory is electrically driven throughout, the machines and the motor connected being as follows:

Four leather-cutting machines and one cloth-cutting machine driven by a three-horsepower motor. Each machine will cut 720 pairs of vamps or of tops per day.

Forty-eight stitching machines, driven by two three-horsepower motors, connected to line shafting by link chains.

Two assembling machines, two pulling-over machines, five Consolidated lasting machines, two sole-laying machines and two pounding machines, all driven by a three-horsepower motor.

In the bottoming room there are one McKay sole-sewing machine (capacity 1,500 pairs per day), three loose-nailing machines, an Atlas leveler, heeling and finishing machines, all motor driven. Energy is supplied by the Salem Electric Lighting Company.

Campaign to Eliminate Isolated Plants in Louisville.

One more of the few remaining isolated plants in the central part of Louisville has been superseded by central-station service, where the Louisville Gas & Electric Company has just contracted with Crutcher & Starks for its lighting service. The home of the company is a six-story mercantile building with about 60,000 cubic feet of space and an elaborate electric-sign equipment. The load is about 100 kilowatts.

Talks to Central-Station Power Salesmen

By C. H. Stevens
Manager, Power Engineering Bureau, Brooklyn Edison Company

In this, the second of a series of articles by Mr. Stevens, the subject of heating is fully discussed insofar as it applies to the analysis of a plant by a central-station power salesman or engineer. The fallacy of the old theory that an engine acts as a reducing valve between the boilers and heating system is shown and many arguments advanced in favor of central-station service. The next article of the present series will deal with the fixed costs of an isolated plant, showing how they affect the cost of power as compared with central-station supply.

This being the second of a series of three articles on "Talks to Central-Station Power Salesmen," we will attempt to deal to some extent with the actual problems which the power salesman has to contend with in selling power. The subject is extremely broad and but a small part of it can be covered in the space allotted here. Hence, the principal or more important problems will only be considered. No hard and fast rules can be given for handling the work, as almost every proposition is affected by certain peculiar conditions which really place it in a class by itself. However, there are certain important problems which appear in most propositions and these are the ones that will be taken up in order of their importance in this article.

Heating.

Undoubtedly the question of heating the building is the most important item in connection with the private plant which the average manufacturer has to consider aside from actual power to be generated. One of the principal arguments against the use of central-station service advanced by those interested in the development of the steam plant and by manufacturers who are securing their power through independent means is the necessity for warming the building throughout the heating season. Every office building and manufacturing concern requires heating throughout part of the year and, realizing the importance of this, private-plant advocates are apt to give undue weight to the heating item, and in a great many instances it is the deciding factor in the question of choice of private plant or central-station power.

Advocates of the private plant, while admitting the many advantages of the central-station product, will maintain that the private generating plant and the steam heating are economically inseparable, and the purchase of electric power from a local power company and generating steam for heating by private means can only be effected at a serious loss. They argue that as exhaust steam from the engine is used, the heat derived from this source is without cost, and the statement is frequently made that the engines merely act as reducing valves between the high-pressure boiler and the low-pressure steam heating system. Private-plant exponents have so long advanced and exaggerated on these arguments and there has been so little opposition against the theory that they have practically been accepted up to the present time as facts, not only by private-plant advocates, but by the stationary engineers and manufacturers. In some instances the central stations themselves, from lack of actual data on the subject, have obtained the false impression of the value of this exhaust steam, and have considered it a serious handicap towards getting business.

This question of the value of exhaust steam is probably the most important problem which we have before us, not in the sense of its having a serious and real influence on the adoption of central-station service, but because the public has been educated up to thinking that it has.

The private-plant advocates will not admit that exhausting the steam from the engine into the heating system will affect to any appreciable extent the steam consumption of the engine. No consideration is given to the question of back pressure, to the fact that a certain amount of heat must be abstracted from the steam in order to produce power, and that the supply of exhaust steam is not coincident with the heating demand.

In most cases, where the central station has compiled comparative reports on private-plant operation versus operation under the central-station system, and the consulting engineers or plant advocates have submitted a counter report, the principal differences are shown in the heating item. Usually these figures on the quantity of steam required for heating are based on formulas from various handbooks, and while it is not here intended to criticize the value of theoretical calculations, the results obtained by the application of say four of the standard formulas given in text books to any given heating problem will give widely different results. The author has in mind one instance in which the amount of coal required to heat a certain building was the deciding point as to whether private-plant service would be continued, or whether central-station service should be adopted. In this case three separate and distinct reports were made by as many disinterested consulting engineers as to the amount of coal required to heat the building in question. In each the results were obtained after a careful study of the situation, although different formulas were used in each instance. The net results varied from 1,600 tons to 2,900 tons per year, and each report from a theoretical standpoint was correct. The figures which were submitted to the prospective customer by the central-station representative were based on actual investigations and data from similar buildings in the same neighborhood, and gave 1,000 tons of coal per year as being sufficient. The coal consumption as given in any of the other reports was sufficiently high to preclude any consideration of central-station service. This contract was closed by the central-station company, and after two years operation the owners of the building reported that an average of 980 tons of coal per year were used.

This goes to show that while theoretical formulas are of help in solving these problems, the better method to derive results is to compile some practical data taken from actual operating conditions. The central-station companies are in a position to collect these data from buildings where they are now supplying electrical service, and where the boilers are used for heating purposes only. Such data cannot be refuted by private-plant advocates, and must of necessity bear weight with the prospective customer.

The power salesman may state without fear of contradiction that the back pressure on the engine when they are exhausting into the heating system very materially increases the steam consumption. It also reduces the engine capacity, which means that in some cases the engines must operate at heavy overloads during the heating season at a loss in efficiency and at a higher rate of depreciation. The power engineer may point out that the exhaust steam available for heating is not at all coincident with the heating demand. In the mornings after the heating

season comes the heaviest demand for steam. The building must be made comfortable before work is started, hence before the engines are operating live steam must be admitted into the heating system. Again, late in the afternoon or evening, when the heating demand is the least, if the plant is carrying a heavy lighting load, the exhaust steam may be considerably in excess of the amount required. Therefore, while the use of exhaust steam in special instances may be economically applied, still in ordinary practice, under average conditions, the supply is not coincident with the demand and little saving can be effected.

Fuel.

An item upon which there is wide differences of opinion is the amount of fuel required to produce power. Some consulting engineers and manufacturers of plant apparatus may make statements, and sometimes guarantees, on steam consumption of their engines and evaporation by their boilers which really are of little real value, as they apply only to theoretical or laboratory practice. Many plant owners have found after several years' operation of their equipment, that the actual fuel consumption bears a very small relation to estimates and perhaps guarantees submitted when the plant was installed. The power salesman must differentiate between these and fully explain to the prospective customer that while these figures may be theoretically true, they have very little bearing on the proposition in hand.

Boiler Performance.

Guarantees of boiler performance of 10 pounds of water or even more per pound of coal are frequently made, and while we will not question the fact that boilers may equal this performance under test conditions, still in every-day practice there are so many factors which enter into this item that such a figure is usually found far from right. An evaporation of 7 to 1 is a fair average for the ordinary industrial plant, and in many instances it is much lower. While occasional boiler tests may show higher rates of evaporation under ideal conditions, the yearly consumption, compared with the amount of power generated, tells the true story.

The power salesman must show to the manufacturer that his figures are based on conservative estimates and on actual practice. Some of the following points may help to prove his contention. The greatest single factor affecting boiler performance is the human element. It is the aim of the average fireman to keep a constant steam pressure on the gauge. He does this in accordance with his own ideas of fuel supply and draft regulation. It is impossible for him to do his work in actual practice according to laboratory or test methods. He is handicapped too by the fuel which varies greatly in different shipments, showing an ash percentage of 5 to 10 per cent and moisture percentage of 2 or 3 per cent in the same grade of coal, and cases are known in which improper regulations of air supply has increased a yearly fuel consumption by as much as 25 per cent. With such points in view it is comparatively easy to show that average boiler evaporation is much nearer a ratio of 7 to 1 than a ratio of 10 to 1.

Engine Performance.

Likewise, figures quoted on engine performance when competion is keen may have little bearing on what the apparatus will do under actual operating conditions. While a certain guarantee of 20 pounds of steam per indicated horsepower made to the manufacturers may hold if the engines carry constant and full load with dry steam at the throttle, these conditions are not met in ordinary practice, therefore such guarantees are of small value in figuring yearly operating costs. Few engines carry constant load at or near their rated capacity throughout the working day, which, of course, results in a reduction in the efficiency; moreover, superheaters must be used to obtain absolutely dry steam at the throttle, and the engine must exhaust into the atmosphere or vacuum and not against a back pressure created by the heating system, in order to even approximate such figures.

The power salesman may also lay special stress on the point that the plant auxiliaries require considerable amounts of steam for their operation and that when the plant is carrying a light load, the generation of power is very inefficient, because the steam consumption of the auxiliaries remains practically constant. A much larger boiler plant is required if the plant is operated by steam engines. Therefore, the cost of banking fires at night is considerably increased and if there is any overtime work to be done, either the day engineers must be paid for their extra time or night engineers must be employed. A special breakdown connection may be contracted for with the local central-station company to take care of this overtime work, but this, of course, carries much higher energy charges than if power is purchased under regular forms of contract and in large quantities, all of which must be added to the plant operating costs.

While the question of heating and boiler and engine performance are the chief technical points which are considered in negotiations of this kind, there are many others which have a more or less important bearing upon its outcome, which will be discussed in a subsequent article.

Central Stations Increase Power Load With Leased Motors.

The several electric lighting companies under the general management of the Gas and Electric Improvement Company, Boston, Mass., have adopted a plan of leasing motor equipment to factories and shops, and a large amount of new power business has been secured on this basis.

A contract is made between the local company and the customer, by which the latter pays for the leased property, as rental, 6 to 8 per cent interest, taxes and depreciation at 9 per cent. The customer may buy the property at any time at a stated price, in which case he is allowed to deduct the full amount paid for depreciation.

Inside wiring may be furnished by the customer, or, if he prefers, the company will wire and install the motors, for which the customer will pay the cost in 12 monthly instalments.

Title remains with the company until full payment, and the customer protects the property and keeps it insured. The lease proposition has been adopted for textile mills, lumber mills and various industrial plants. Nearly 50 per cent of the new business has been gained through this medium. During the last 6 months of 1915, 827 horsepower were contracted for. The following are the individual companies employing this plan:

North Adams Gas Light Company, Northampton Electric Lighting Company, Spencer Gas Company, Adams Gas Light Company, Williamstown Gas Company, Leominster Electric Light & Power Company, Ayer Electric Light Company, Milford Electric Light & Power Company and Harvard Gas & Electric Company.

First Electric Steel Furnace Installed in Alabama.

What is said to be the first installation of an electric furnace in the south has recently been made at Anniston, Ala., for the Anniston Ordinance Company. The furnace is of the arc type, Heroult model. Energy is supplied by the Alabama Power Company, of Birmingham.

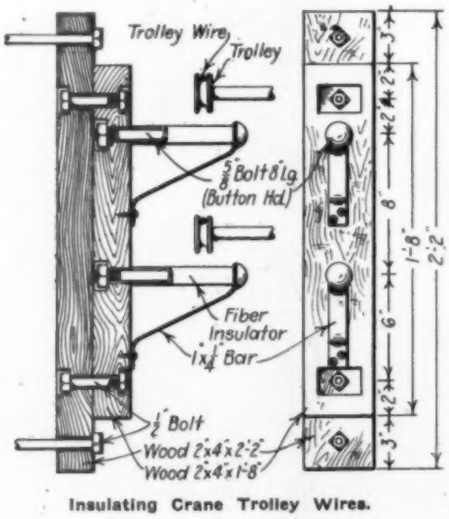
ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

Method of Insulating Traveling-Crane Trolley Wires from Crane Girder

In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of March 4 are some answers by inspectors regarding the wiring of traveling cranes. In this connection the question also came up of the best way of insulating the wires from the crane girder. In the accompanying sketch is shown the method I have found best for this purpose. What is necessary is some means for supporting the trolley wires and also keeping them from touching or swinging against the girder.

The general arrangement of these supports is well shown in the diagram. Since very high voltage is seldom used on the cranes, the two wood strips of 2 by 4 mounted as shown, provide ample insulation. The trolley wires normally rest upon the long bolts provided with button heads, being insulated therefrom by means of a fiber insulating tube. As the crane trolley comes along, each wire is temporarily lifted and again drops upon the fiber tube after the trolley has passed. Occasionally the wire may slip off from the device. To bring it on top of the tube again I have used a curved iron bar about one inch wide by one-fourth inch thick, which is shaped and mounted in the manner shown. This acts as a guide to throw the wire back on top of the fiber insulators as the crane trolley again approaches. The button-head bolts must have good round heads so that the wire can slip over easily. Formerly we had trouble with the trolley



Insulating Crane Trolley Wires.

wires slipping from the supports and when the trolley wheels would approach to pass over the supports it was found they would either break the wire or the support. After putting on these guide bars the trolleys easily carry the wire back into place as they approach. Since putting on this arrangement we have not had any broken trolley wire for over two years. Each trolley wire has a turnbuckle at the end, or use a hook bolt with strain insulator at the end.

W. D. Wilson.

DIRECT-CURRENT MOTOR STARTERS.

By J. H. McIlroy.

When a motor is at rest the speed, and consequently the counter electromotive force, is zero, so that if the impressed electromotive force be applied directly to the motor terminals the current $I=E/R_a$, where R_a is the armature resistance. And since R_a is only a small fraction of an ohm, the current I would be excessively large. Therefore in order to avoid this heavy rush of current a starting resistance must be put in series with the armature and cut out step by step as the motor speed increases, until at full speed the only resistance in circuit is that of the armature itself.

When starting rheostats were first introduced, the invariable practice was to distribute the resistance equally between all steps. This method, however, was soon discarded, as it gave very unequal increments of current, the result being excessive sparking and uneven acceleration.

The current i required to start a motor with its load from rest is greater than the full-load current I. When the switch arm is moved to the first contact of the starter the counter electromotive force is zero, and the motor current is expressed by $i=E/(r+R_a)$ where E denotes the pressure of the supply mains, R_a the armature resistance, and r the starting resistance in series with the armature. If n denotes the number of steps into which the resistance is divided, then $r=r_1+r_2+....+r_n$. Let e_1 denote the counter electromotive force generated when the switch arm is on the first stud and the motor has accelerated until the current I is steady, then $I=(E-e_1)/(r+R_a)$. When the switch arm is moved to the second stud the resistance will have been diminished by r_1, and before the counter electromotive force increases the current i is expressed by $i=(E-e_1)/[(r-r_1)+R_a]$. Each time the switch arm is moved from one contact to another, the current will suddenly increase and then fall as the counter electromotive force increases. The current I is that required to provide the necessary torque for accelerating the rotation of the armature; and the value of the resistance cut out in each step should be such that the ratio i/I is constant during the period of acceleration.

$$i/I=R_1/R_2=R_2/R_3=R_{n-1}/R_n.$$

The ratio i/I for a starting resistance having n steps is given by the equation $(i/I)^n=E/iR_a$. Hence $n \log (i/I)=\log (E/iR_a)$. Therefore the number of steps n required so that the current shall not exceed i amperes during acceleration is given by the equation $n=\log (E/iR_a)/\log (i/I)$.

Having determined the number of steps required for a given starting resistance, the resistance required for the first step is given by $r_1=(r+R_a)(1-I/i)$. Similarly the resistance required for the second step $r_2=(r-r_1+R_a)(1-I/i)$ and the resistance of any step n of a starting resistance is given by the equation $r_n=(r-r_1....-r_{n-1}+R_a)\ (1-I/i)$.

Example.

Determine the number of steps and resistance per step for a 10-horsepower, 220-volt, shunt-wound motor whose full-load current is 38 amperes; the starting peaks must not exceed 56 amperes. The armature has a resistance of 0.35 ohm. The number of steps in which the resistance must be divided is

$$\log \frac{220}{56\times 0.35} / \log \frac{56}{38} = \log 11.2/\log 1.47 = 6 \text{ (about)}.$$

With a start-

ing current of 56 amperes, the starter being hand-operated, it should be built to attain this value of current in two steps; so that the actual number of steps should be 7, that is, there will be 8 contact studs.

On the first contact 28 amperes should be allowed to pass through the motor, so that the total resistance in the armature circuit when the switch arm is moved on to the first contact stud $=220/28=7.855$ ohms. Since the motor should start on the second contact stud and the starting current should not exceed 56 amperes, the total resistance in the armature circuit when the switch is moved on to the second contact $=220/56=3.928$ ohms. But the armature has a resistance of 0.35 ohm, so that the resistance between contacts 2 and $8=3.928-0.35=3.578$ ohms, while the resistance between contacts 1 and $2=R_1=7.855-3.928=3.927$ ohms. The second step of the starting resistance, or the first step for which the current is equal to the starting current $=r_1=(r+R_a)(1-I/i)$

$$=(3.578+0.35)(1-38/56)$$
$$=3.928\times0.32=1.257 \text{ ohms.}$$

Again, the resistance of the third step

$$r_2=(3.578-1.257+0.35)\ (1-38/56)$$
$$=0.85 \text{ ohm.}$$

Similarly $r_3=058$ $r_5=0.27$

$r_4=0.39$ $r_6=0.18$.

Thus by making the resistance steps of these values the ratio I/i is constant and an even acceleration of the motor is obtained.

Resistances.

The resistance coils of motor starters are generally made from high-resistance metals or alloys. The size of wire required for any particular case may be found as follows. Let R=resistance of the wire in ohms, a=area of cross-section, l=length and ρ=specific resistance; then the rate of generation of heat due to the current I flowing is I^2R watts$=0.24I^2\rho l/a$ calories per second.

Let s denote the specific heat of the metal, g its specific weight, and T the temperature rise in degrees per second above the surrounding air. To produce the rise of temperature in one second the heat generated$=l\,a\,s\,g\,T$ calories.

Owing to the short period during which the motor is under acceleration, the heat radiated may be neglected, in which case $l\,a\,g\,s\,T=0.24I^2\rho l/a$, or the rise of temperature per second, $T=0.24I^2\rho/a^2sg$. Suppose the wire carries the current I for t seconds, and let Tt=the permissible temperature rise of the resistance.

In the starting resistance calculated in the preceding example find the size and length of wire required in the last step. It may be assumed that the resistance wire used has a negligible temperature coefficient and that 30 seconds are required for starting. The permissible temperature rise is 150 degrees, so $T=5$. The average current is 47 amperes. For platinoid wire $\rho=0.00004$ ohm-centimeters; $g=8.6$, and $s=.098$. The area of cross-section of wire$=a=\sqrt{0.24I^2\rho/sgT}=$

$$47\sqrt{0.24\times0.00004/5\times0.098\times8.6}$$
$$=0.071 \text{ square centimeter.}$$

Diameter of wire$=d=0.30$ centimeter.

Nearest size of wire diameter in mils$=119$.

Length of wire to give the requisite resistance of 0.17 ohm $=l=aR/\rho=0.071\times0.17/0.00004=302$ centimeters.

A Starting-Box Remedy.

On circuits where the current is on and off the lines suddenly, caused by opening of the circuit-breakers, motor fuses are frequently blown if the starter does not release and open quickly. Slowness in the starter handle releasing is frequently caused by the retaining magnet being stronger than necessary.

A simple remedy for this trouble can be applied by prick-punching the magnet armature where it makes contact with the core of the magnet frame. The slight bur will increase the air gap and thus weaken the magnetic pull.

R. L. Hervey.

English Wiring Rules.

The seventh edition of the Wiring Rules of the Institution of Electrical Engineers appeared last month. The rules have been revised since last published. Among the requirements of these rules are the following:

When wires larger than No. 16 S. W. G. are used in fittings of any kind, they must be stranded.

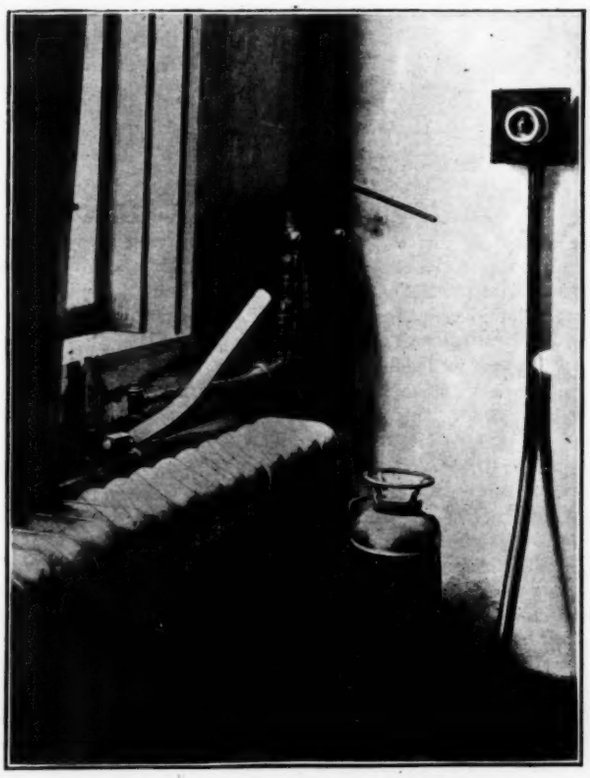
Slip sockets are no longer permitted in conduit work, but a screwed or grip joint must be used.

Insulated conductors protected by an outer reinforcing of tough rubber compound not less than 50 mils thick and capable of resisting abrasion, acids, oils and alkalis may be used without conduits or wood casing provided that (*a*) the resistance of the covering to fire is equal or superior to that of vulcanized rubber and (*b*) that the covering incloses the insulated conductors as a whole or each insulated conductor separately.

All heating devices which consume over 1,000 watts must be provided with double-pole switches.

Pneumatic Door-Opener for Garage.

At the garage of the Greenfield (Mass.) Electric Light & Power Company the main sliding door is opened and closed by an air cylinder, as shown in the accompanying photograph. A 0.75-inch steel plunger traveling in a 1.5-inch cylinder operates the door upon the turning of one of two engineer's valves shown in the corner of the room. Despite the fact that the door is 10 feet 6 inches by 13 feet by 2 inches in dimensions, it can be opened or closed in



Pneumatic Door-Opener for Garage.

3 or 4 seconds. A home-made brake shoe with hand lever, shown behind the radiator, enables the door to be stopped immediately at any point in its travel. Compressed air from the garage system is supplied through a 0.375-inch pipe at about 40 pounds per square inch. The switch shown herewith controls the outside lighting, at the approach to the garage.

Prevention of Accidents by Electrical Workers.

A recent prize offer by *Safety Engineering* brought forth the following advice for the electrical man on the job.

In the installation or maintenance of electrical equipment, one is confronted with an element of danger not encountered in other lines of work, and in the performance of duties one must exercise carefulness, watchfulness and prudence to avoid difficulties.

Electrical work is a calling where caution is a prime virtue, and fortunate are those in whom this faculty is largely developed, because it exerts a restraining influence over the more propelling forces of one's nature, and prevents one from plunging into danger.

Safety demands that one must be constantly alert, especially where high potentials are handled; in the vernacular of the craft, the "juice" is prepared at all times and places to deliver without warning a "knockout" to the unfortunate victim caught off guard.

Of course there are unforeseen possibilities in all situations. It is difficult to guard against unknown peril, but where danger is manifest and an accident occurs it is invariably shown to be amenable to human control.

To one engaged in electrical work a thorough knowledge of the fundamental laws that govern the action of electricity is a necessity. They are immutable laws and, once mastered, the worker can in a measure guard against mishap, because he can think and act for himself.

"Live" and "dead" electrical conductors are identical in appearance. This fact alone serves to emphasize the importance of treating all apparatus as "hot" until definite indications to the contrary are shown by an application of tests.

It displays sound sense on the part of the worker to survey his surroundings, analyze the conditions and securely fortify himself before proceeding with any work. It is equally important to see that every precaution is taken to preclude any possible chance of the apparatus or circuit being livened up while working upon it.

One should not depend upon the "say so" of another. It is best to test, because the information imparted may not always be absolutely correct. If, for any reason, an employee finds it necessary to leave his work for a short time, on his return it is a wise precaution to always give the job "the once-over," as a brief investigation might show some change in conditions to make further work unsafe.

A job not well done would better be left undone. Careless work should not be tolerated. Just because the work is concealed and not likely to be condemned is no excuse for slighting it. Even if it does not offend the sense of good workmanship, the worker should at least show some consideration for the safety of the next man on the job.

One should never allow himself to become so inured to the presence of high voltages as to cause him to slacken his tension on concentration. When an employee finds his surroundings uncongenial, his work uninteresting, it is high time to seek another position, because with interest centered elsewhere, work becomes a reflex action, and a most vital point in "Safety First" is lost when a worker does not think.

One should never overlook the importance of apparently insignificant things. A little attention at the proper time will often avert a serious accident. It is well to remember that it is easier to quench a spark than a fire.

A worker should never allow his vigilance to relax even in the handling of low-voltage systems. The harmonic pulsation received by a contact with 110 or 220-volt alternating current is not a pleasant sensation and it is extremely dangerous if one happens to receive a jolt while working from a step ladder or scaffold; the sudden involuntary contraction of the muscles may cause one to drop a tool or lose his balance.

One whose position involves the handling of "hot stuff" cannot afford to commit blunders, as the penalties are too severe. Even if the unfortunate one survives an encounter, the pyrotechnical display that invariably accompanies a short-circuit is certain to leave a trace of damage which will conspicuously fix the incident in the memory of the victim.

Frequently an employee in his haste to restore service after an interruption will overlook his personal safety. It should always be borne in mind that it is vastly more important to preserve a life than the continuity of a circuit.

It is very poor practice to carry tools about the person, and more so if they are not properly insulated; in fact there is no necessity for it except on line work.

Good thinking can come only from a clear brain and it is the worker's duty to keep his gray matter in perfect working order, at least while on the job.

The writer is no disciple of prohibition doctrines, yet he believes it a grave mistake on the part of a worker to appear on the job burdened with a 50-per-cent overload of the products of some distillery; he not only exposes himself to danger but he also jeopardizes the safety of his fellow workmen.

The worker should at all times welcome any new appliance and readily respond to any suggestions tending to minimize accidents.

When a fatal accident occurs, employers experience little difficulty in securing applicants for the worker's position, but it rarely happens that the vacancy created in his family circle is ever satisfactorily filled. It is well for the worker to pause at this point long enough to have this fact made perfectly clear to his mind.

Among the Contractors.

Miller & Halls, electrical contractors, 264 Stark Street, Portland, Ore., have been awarded the electrical contract for the proposed new mill of the Inman-Poulsen Lumber Company, which recently burned and is to be rebuilt immediately. The contract is for the wiring to be used in connection with all power apparatus.

The contract for electrical wiring for the new DuBois School, Springfield, Ill., has been awarded to the Barth Electric Company, on its bid of $1,269.86.

Control of the Louisville Wiring & Fixture Co., of Louisville, Ky., is now in the hands of I. P. Barnard, who has purchased the interests of C. C. Herman and H. D. Catlett in the business.

H. B. Lucas will establish an electrical contracting business at Owensboro, Ky. He formerly was with the Rogers Electrical Company.

The State Board of Control recently awarded the contract to the Liberty Electric Company, of Aberdeen, Wash., for furnishing and installing electric fixtures in the Administration Building, State School for Girls, at Grand Mound, Wash.

Titus Schmid has become associated with J. Lowe in the electrical contracting business in Dubuque, Iowa, and the firm name will hereafter be Schmid & Lowe. The association of Mr. Schmid with the firm means the bringing in of additional capital and the branching into newer channels of trade.

The new electrical firm of Strite & Stine has opened for business at 353 West Second Street, Waynesboro, Pa. Their specialty will be charging automobile storage batteries, house wiring and furnishing complete electric light plants for farms and residences.

E. A. Emery, of Galva, Ill., has received the contract for all the electrical work for the new Parkside Hotel at Kewanee, Ill. This hotel is to be fireproof throughout and will cost about $100,000. All the wiring will be in conduit.

Loose-Leaf Sheets a Convenience for Troublemen.

When a troubleman is sent out to repair a fault on an electric circuit he should have an accurate and conveniently arranged diagram of the circuits to be investigated or worked upon. In the Worcester (Mass.) Electric Light Company's distribution department troublemen are furnished with exceptionally convenient letter-sized loose-leaf sheets, as reproduced herewith, to enable them to carry accurate information as to the line conditions about the system with ease.

Fig. 1, which is a typical street-lighting sheet, shows at a glance just what parts of a particular circuit are of overhead and what portion of underground construction, the location of each arc and incandescent lamp on the circuit, and the route of the wire with all loops on a correct geographical scale. On the circuit illustrated, which starts from the Webster Street generating plant in underground cable, there are 56 series arc lamps and 21 series incandescents. The major part of the line is underground, but some of the loops on the side streets run overhead, as shown. In case of emergency repairs, reconstruction, etc., the map is of great convenience. To enable the sheets to be used outdoors in strong winds, those made for field service are white-printed on cloth, a celluloid cover being used at the front and rear of the book to protect the sheets in handling them. In reducing this sheet for the engraving, its clearness has been somewhat spoiled. The originals are very easily read and entirely to scale.

Fig. 2 is a map of a power circuit, all three-phase and single-phase transformers being shown by symbols, with the size of conductors, location of oil switches, taps to various industrial plants, the number of conductors installed at various points, etc. Another sheet showing the detailed connections in the Park Building, which is on this

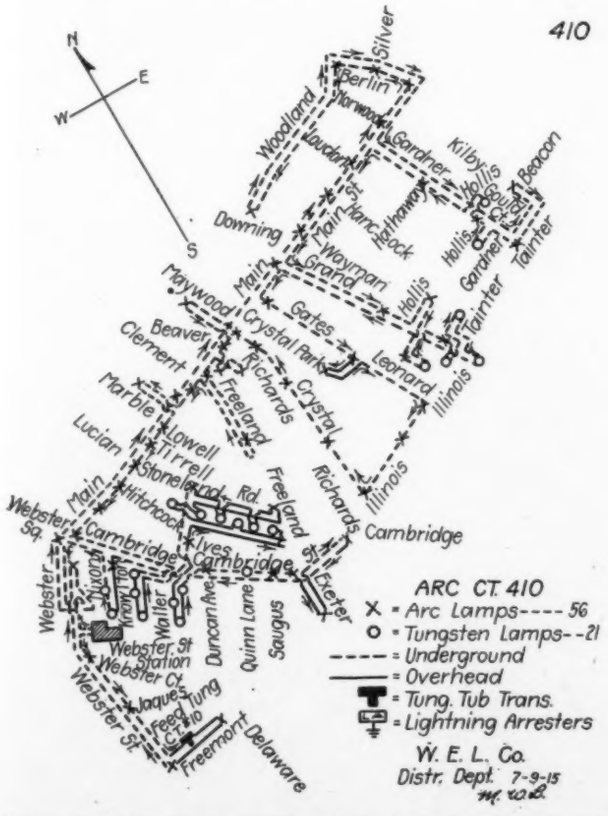


Fig. 1.—Typical Street-Lighting Sheet Showing Overhead and Underground Circuits.

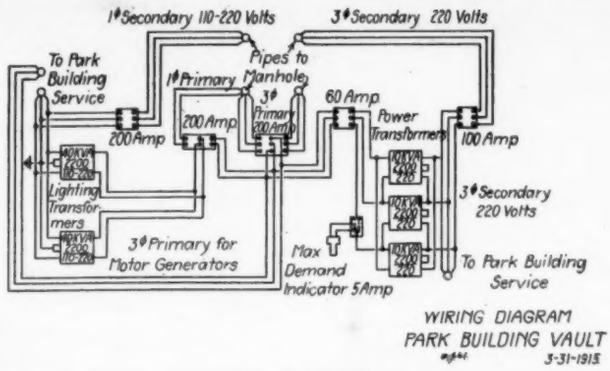


Fig. 3.—Record Sheet Showing Detailed Wiring Connections in a Building on Central-Station Service.

circuit, is shown in Fig. 3. This shows in detail the arrangement of cables leading to power and lighting transformers from the service manhole outside the building, connections of the demand indicator, primary circuit leading to motor-generators employed in furnishing direct current to elevators and dental motors, and the possibilities in the way of feeding through the building substation in emergencies.

The value of such diagrams becomes the greater as the circuits become more complex and especially so when service on circuits must be restored as quickly as possible. The "safety first" element also is an important feature taken care of by an accurate and easily understood diagram. Although most of the large central-station companies have developed sets of such diagrams for load dispatching and trouble hunting, not so many of the smaller companies and but few industrial plants have ever taken the trouble to make simple and condensed diagrams especially to facilitate trouble hunting. Usually the circuit layout is left to the memory of only one or two men and in their absence long delays and serious difficulties may result.

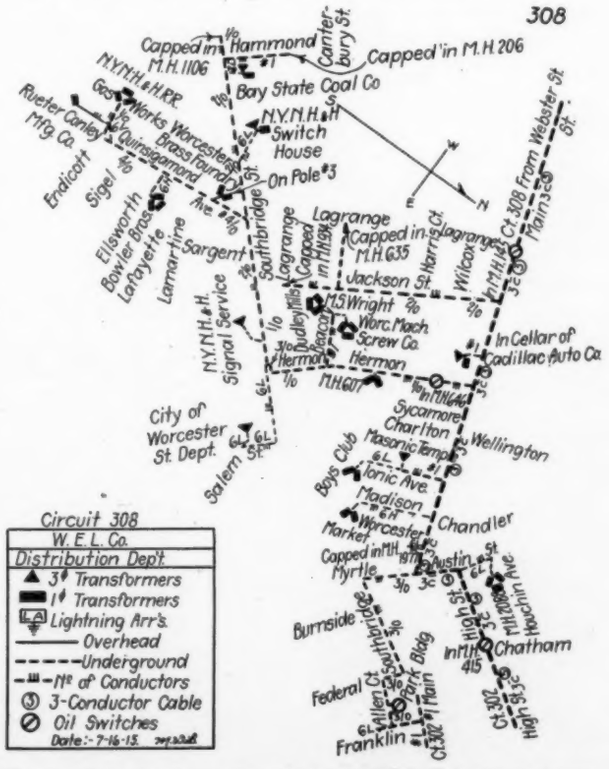


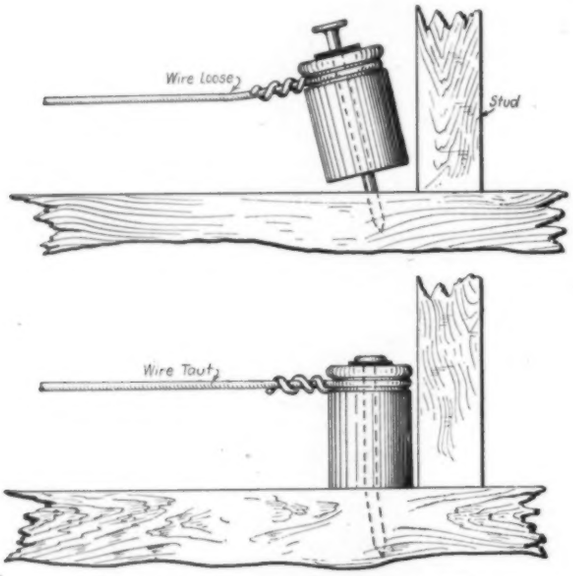
Fig. 2.—Map of a Power Circuit Showing Types of Transformers, Size of Conductors, Location of Switches, Etc.

DOLLAR WIRING KINKS

Every reader is invited to contribute to this page. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

To Insure Taut Wires in Knob-and-Tube Work.

I notice on many jobs of knob-and-tube work in which solid knobs are used much trouble is found in getting proper strain on the wire in cases where the knob must be set very close to a stud or other obstruction. I find that a good way to make a tight job is to start driving the nail for the knob on the slant, then as it is driven home the nail is hammered in straight, causing the knob



Tightening Wire in Knob-and-Tube Work.

to straighten up and draw the wire taut. A sheet of glass, slate or other insulating material should be put between the stud and the adjoining knob.

E. C. Sylvanus.

Taking Up Floor Boards Neatly.

In taking up flooring to conceal wires, I find that a large amount of work and trouble can be saved by first ascertaining the grooved side of the boards. Then by driving a flat chisel slantingly under the board to be taken up so as to break off the lower part of the groove, the board can be pried up easily, leaving the surface in good condition to be replaced. I find this to be better than to drive the chisel straight down and cutting off the tongue, because on replacing the boards they lie more nearly flush if at least part of the tongue is left.

E. A. Davidson.

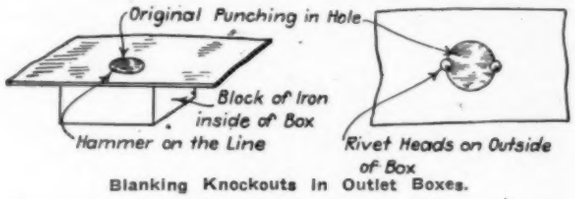
Fishing Wire into Bent Fixture Arms.

An easy method for fishing wires into various kinds of bent fixture arms is to take a long piece of bead chain, such as is used for pull-chain sockets, and put one end of the chain into one end of the fixture arm. By gently tapping the arm you will find that the weight of the chain will carry it around in whatever angle you are holding the arm. By doing this you will find that the chain will slide right through to the other end of the pipe. Next you tie your fixture wires to the end of the chain and pull them through gently so that you will not break the chain. In some cases it will be desirable to first pull through a strong, smooth cord by means of the chain and then pull the wires through by the cord.

Walter Morris.

Blanking Knockouts in Outlet Boxes.

The neatest, quickest and easiest way to stop up knockout holes in cutout boxes is to rivet the punching, which



Blanking Knockouts in Outlet Boxes.

comes out of the hole, back into place again. If a heavy hammer or flat-faced block of iron held inside the box and a light hammer applied outside does not accomplish the trick, two small rivets, as shown, will do it.

A. F. Stearns.

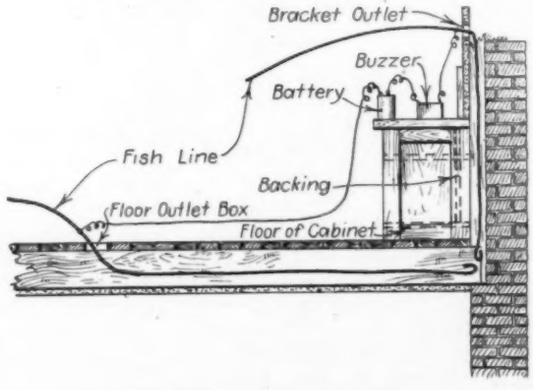
Handy File for Fixture Work.

I find that a three-eighths-inch round file is a very handy tool for the fixtureman's tool bag. The tapered handle end can be used for a punch and reamer to make socket bushing holes in canopies. If a larger hole than the end can ream is wanted, it can be filed to the required size, In pulling fixture wires out of a bad bend in a fixture fitting, the handle end point can be made into a small hook that is a great help in pulling wires through an arm.

M. J. Moriarty.

Simple Test as Aid for Hooking Snakes.

An easy way to find whether the ends of two snake wires used in fishing difficult places in ceilings and partitions are near each other is by means of dry cell and buzzer connected in on the wires as shown. One side of the circuit is connected to one of the snake tapes and the other side of the circuit is connected to the other tape. When the two snakes come in contact the buzzer sounds. In the accompanying sketch is shown a case



Test Used in Hooking Snakes.

where this test proved effective. It was required to install a floor outlet near the center of the room and the nearest other outlet to it was a bracket above the sideboard built in at the wall. Since the cabinets in the bottom of the sideboard were provided with false floors and separate backing it was not possible to get at the baseboard. In this case two snakes had to be used and the simple test facilitated the work.

W. Morris.

CORRESPONDENCE AND DISCUSSION

A Reader's Page Wherein Opinions on Topics of General Interest May Be Expressed

Electrolysis.

To the Editor:

Your editorial on electrolysis in the issue of January 22 was indeed interesting. It is a true description of its effects and the remedies offered for its prevention.

To the knowledge of the writer there has been much expense incurred in experimenting along these lines. We hear the British Board of Trade regulations referred to and other European methods cited. These are no doubt good as far as they go, but here in this country we have more to contend with than they have in Europe. Our street railways and other loads are much heavier and more surging; our underground pipes and cables are more numerous and laid with practically no regulation as to depth and location. Generally they are all connected in one great underground circuit.

To the network of pipes and cables let us add the steel buildings, with their footings deep down in the ground and see what an enormous ground-plate we have to collect stray current. We all know that electricity will go to ground. That is why we have to insulate conductors and equipment. In all cities there is a part of the street railway system where the rails are positive to the underground pipes and cables and other parts where the rails are negative to the pipes. The average inspector would call this a good condition, yet in such cases we have two parallel lines with an earth connection between them, where the current will equalize.

In what is commonly called the "danger zone" will be found a direct reversed condition, where the pipes and cables are discharging back to the rails. At these points the effects of electrolysis are plainly visible. A great deal more could be said on this subject, but not desiring to impose on your space I will confine myself to the remedy as I see it.

After many years of labor along this line, I can see but one permanent, sure remedy, and that is the porcelain pipe insulator. By its use it is possible to clear up any electrolytic troubles, no matter how large or small they may be. The result obtained from its use is governed by the number installed. It is possible to clear up the average pipe line by installing an insulator about every one thousand feet, with an occasional service pipe insulator close to the main where the pipes cross under the track. These insulators will increase the resistance in the main so that it will not carry current. In other words, if the route of the current in the pipes is obstructed, the pipes will not collect current at either adjacent or remote points.

It is not true that an insulator is dangerous in a pipe, for the electric current will not pile up against a resistance. The difficulty has been that where pipe insulators have been used, enough of them have not been installed.

There are few types of insulators that are safe to use. An insulator for water or gas service pipe should have an inside insulation of not less than twelve inches and outside break of not less than eight inches and main insulators twelve inches inside. Outside insulators may be reduced to four inches, by covering the surface of the insulator with some substance to keep it free from earth moisture.

A composition insulator will not meet the requirements, as it will saturate, leak current and disintegrate in a comparatively short time. A leaky insulator is much worse than none at all. It is difficult to insulate a main larger than eight inches, but by insulating the small ones and the branches leading to the large ones, it will be unnecessary to insulate the larger ones.

Sheaths of underground power and telephone cables are frequently collectors of large amounts of current. In such cases they lead into danger zones and drain to other cables, pipes or structures. Insulators put into the sheath of such cables will prevent current travel and consequent electrolytic action.

It will often be found that two service pipes in the same building coming from opposite directions, from two separate systems, say water and gas, will show considerable difference in voltage. The pipe insulator will eliminate this difference and reduce the danger of basement fires.

Edward Heydon.

Indianapolis, Ind.

Concentric Wiring.

To the Editor:

In regard to the answer to Question 330 concerning concentric wire, published in your issue of February 19, 1916, I would call attention to the fact that if the seam opens all that has been done is to reduce one of the special safety features of concentric wire, but even then it is less dangerous than the ordinary installations.

In the ordinary installations the insulation is depended on to protect the potential wire.

In the concentric wire of the Kuhlos type this insulation is protected against mechanical injury by the outer sheath, which has an open seam.

The outer sheath also protects it largely, but not absolutely, from moisture or corrosion, because a little moisture can get in through the open seam.

In the Stannos wire the insulation is protected permanently against mechanical injury, against corrosion and moisture. Even if the seam is abused and breaks open the wire is then as safe and good as the Kuhlos; and in any case, the potential wire is better protected than in any ordinary system.

R. S. Hale,
Chairman,
Committee on Wiring, N. E. L. A.

Boston, Mass.

Disposal of Wood Waste.

To the Editor:

In reference to article on this subject in the March 11 issue would say that the matter of securing power contracts where there is a large amount of wood waste available is certainly a very important one. As stated in the article, each particular case has to be treated on its own merits.

There is one point which might be brought out in connection with the use of shavings and sawdust as a partial supply of fuel, and that is that when this waste is blown into the fire of the ordinary furnace it burns at very low efficiency due to the large amount of cold air which is blown in on top of the fire. This also lowers the efficiency of the coal used as possibly the main source of fuel supply, and thus materially reduces the efficiency of the boiler plant. Specially designed furnaces are necessary if reasonable fuel economy is to be secured.

George H. Jones,
Power Engineer,
Commonwealth Edison Company.

Chicago, Ill.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be received preferably within ten days of the date of publication of the question. Payment will be made for all answers published.

Questions.

No. 341.—Controller for Bascule Bridge.—A bridge-machinery designer has told me that it is impracticable to introduce any automatic control features for the motors operating bascule bridges because of the variable load due to wind, sleet, etc. Have any bridges of this type ever been equipped with automatic controllers, or at least automatic limit switches to prevent smashing or upsetting the bridge leaves or breaking the machinery from running too far?—W. W. G., Wilmette, Ill.

No. 342.—Trouble Finders.—Please have some one among the questions and answers contributors explain for me the principles on which the wireless electrical pipe and trouble finders are built and operated. Please show by simple diagrams the methods of wiring used in both the exploring coil and wave transmitter.—F. A. B., St. Joseph, Mich.

No. 343.—Theater Emergency Lights.—Rule 38*a* of the National Electrical Code provides that "where supply to a theater cannot be obtained from two separate sources, the feed for emergency lights must be taken from a point on the street side of main service fuses." Has this provision been found ample for the purpose? Would it not be desirable to insist on an entirely independent source, such as a storage battery?—J. H. R., Pittsburgh, Pa.

Answers.

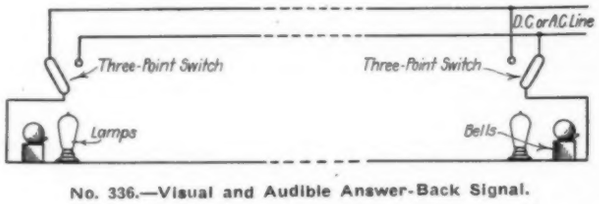
No. 333.—Electric Car Heating.—Has any system of electric heating been developed for electric street cars, elevated or subway trains, which gives a more uniformly distributed heat than the electric coils now commonly used under the seats? I have heard many complaints on very cold days that the seats are uncomfortably hot while the floor is chilly.—A. P. G., Chicago, Ill.

The present tendency is toward the more sanitary floor of composition or concrete. Obviously, the floor under these conditions will be quite cold during the winter months. The only remedy, namely, to put the heater coils in or under the floor, is out of the question on account of the cost and maintenance expense. Where there is a good circulation of air in the cars it will be found that few of the radiators overheat unless damaged. The great source of trouble seems to be in educating people to take sufficient fresh air to allow a thorough circulation of air in the vicinity of the heater. The older types of car heaters were placed much closer to the seat than is the present practice and these old cars are the only ones where too hot a seat may be found, except, of course, cases of damaged heaters, which are very infrequent. The old wood floors, though insanitary, can hardly ever be found to be cold, and never as cold as the newer flooring. This is not of sufficient moment to reject the newer materials.—H. E. W., Chicago.

In those cars heated by a hot-water system overheating of the seats is not noticed and the car seems to be uniformly comfortable. Where the hot water is heated in a coal-burning heater, objectionable gases (carbon monoxide, carbon dioxide, etc.) are very commonly given off. Therefore it seems to me that combination electric and hot-water radiators would solve the problem. At least one type thereof is now on the market. Should there be fear that the hot water will freeze when the cars are left over night in exposed yards, another type of combination electric-radiator in which oil is used as the circulating medium could be used. The advantage of all such combination radiators over the straight electric is that they have a much larger radiating surface, retain the heat better after current is off and do not overheat any part.—J. L. G., Oak Park, Ill.

No. 336.—Visual and Audible Signal.—I should like to know whether it is possible (and if so, how) to wire a simple but positive signal system which will indicate at the same instant at the sending and receiving points by means of lighting red lamps and ringing large gongs for perhaps half a minute. That is, the man at the sending end must know positively by the lighting of his lamp and ringing of his gong that the combined signal was properly actuated at the receiving end without a special answer-back signal.—G. S. C., Joplin, Mo.

Signaling systems of this type have been in use for some time, especially in mining, electric railway work, etc. When used in mines they are so wired so that where there are several transmitting points on the line, all the indicators will operate on the line, whenever operated from any point. This prevents the operation from interfering with signals sent by other operators to the engine room. Of course, in this case the engine room is always the receiving end. The other receiving apparatus installed at each transmitting station is used both for test, to see that all is working properly, and also a precautionary measure to prevent more than one signal being sent in at a time. These signals are manufactured by any good signal manufacturer. If it is only necessary to have a receiving and a sending station to act as either, a simple way of doing it is the method used by street-railway companies. The sketch shown herewith will illustrate it. It can be used on bat-

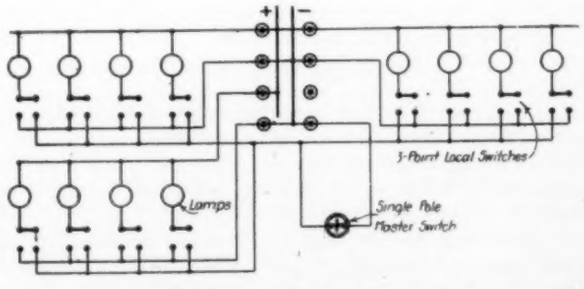


No. 336.—Visual and Audible Answer-Back Signal.

tery systems, direct-current circuits with a lamp bank in series, or alternating-current system with a bell transformer and alternating-current tuned bells. Low-voltage lamps should be used, so that with a low-voltage supply serious burning at contacts is prevented. After the signal has been actuated for a long enough time, turn the sending switch to the other point, so that the other operator can answer back showing he understood the signal.—W. T. E., Ansonia, Conn.

No. 337.—Master Switch for House Lighting.—There are thirty lamps in a house arranged on three circuits. It is desired to be able to light all of the lamps throughout the house by means of a master switch placed along the bed of the owner in one of the bedrooms. I have heard that it is possible to do this. What special wiring is necessary?—O. P., Lewiston, Idaho.

To control all 30 lights at one time from a master switch run the feeders direct to a double or triple-pole switch (depending on the number of wires in feeder) located in the

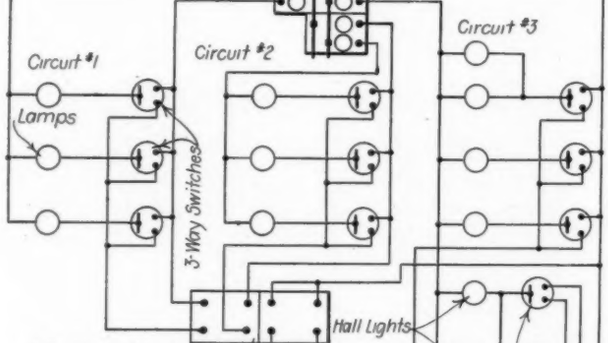


No. 337.—Master-Switch Wiring.—Fig. 1.

bedroom. To control some of the 30 lights as emergency lights and the others for general purposes use three-point switches as local switches for all emergency lights and with a two-wire supply a single-pole switch as a master switch, as shown in Fig. 1. With a three-wire supply a double-pole switch is used as two single-pole switches for this purpose.

The master switches must be protected by fuses of proper capacity before passing to the feeders as shown in sketch and not more than 32 sockets should be placed on one master switch; as this usually only controls one light in each room it is ample for most purposes. On the three-point switches the heel is a permanent connection placed on the back of the switch by the manufacturer. By using two three-point switches in place of one single-pole master switch, the master control can be had from two stations, if desired.—A. T., New York, N. Y.

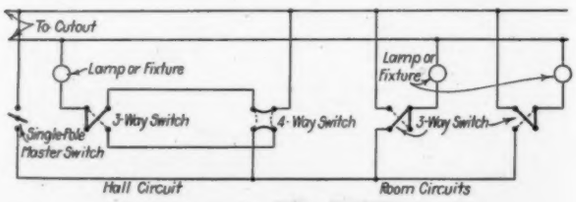
The diagram (Fig. 2) shows three circuits wired up with master switches. Each circuit is kept separate and the whole 30 lights will not be thrown upon one set of fuses



No. 337.—Master-Switch Wiring.—Fig. 2.

at entrance switch, as in case of one single-pole master switch for the entire house. By using two double-pole flush switches, only two buttons will have to be pushed, and the lights will still be protected by their respective circuit fuses. To have positive master control, there should be at least one keyless socket (preferably locked) in each room and hall, these sockets or fixtures being controlled by the three-way switches indicated. In the lower right corner of the sketch is shown one way for including in the master-switch control one or more hall or stairway lights, which are themselves controlled from two places by the ordinary three-way switches.—J. B. S., Chillicothe, O.

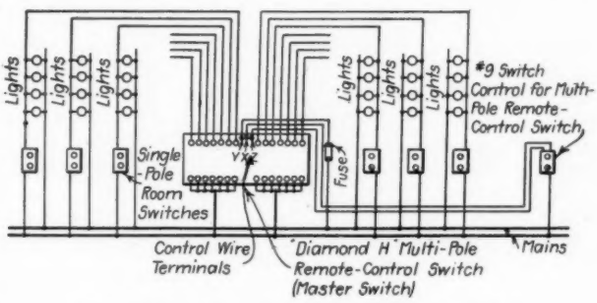
In wiring the house for master switch I suggest the following for use with three-way-switch circuits in hallways: Instead of using two three-way switches as ordinarily, use one three-way and one four-way connected as shown in Fig. 3. This does not affect in any way the number of four-way switches that may be used between the three-way and four-way switches. A four-way switch may also be



No. 337.—Master-Switch Wiring.—Fig. 3.

used as a three-way in case of emergency. The hall light or fixture must be connected to the three-way switch and not the four-way, For the ordinary room circuits a three-way switch is used for each lamp or fixture to be controlled locally. These are connected to the master-switch circuit as shown. Only one lamp or fixture is shown on each of the two room circuits; of course, there may be as many as 12 lamps on each of these circuits. Proper fuses (not shown) must be used.—W. W. F., Philadelphia, Pa.

The best way to wire for a master switch is to use single-pole switches for each fixture or room, all wired on the same side and run a tap from this side to a remote-control master switch located near the main cutout cabinet in the basement. I have used for this purpose a "Diamond H" multi-pole switch made by the Hart Manufacturing Company. The wiring is shown in Fig. 4. Any number of circuits or lamps can be controlled in this way. The con-



No. 337.—Remote-Control Master Switch.—Fig. 4.

trolling switch is just like an ordinary flush wall switch. It momentarily closes the solenoid circuit of the master switch to open or close the latter.—D. K. N., Brooklyn, N. Y.

No. 338.—Grounding of Motors.—What is the best way to ground a group of motors? Can motors of different voltages be connected to the same ground plates, say in the case of 110, 220 or 440-volt alternating-current machines?—R. B., Jackson, Mich.

A copper or steel sheet cut to the size of the motor frame and placed between the frame and base, makes a good ground plate for the motor end of the ground connection. The motor frame, of course, is bolted to its base so that a good connection is made between the frame and ground sheet. The ground wire should be bolted and soldered or riveted to this sheet. Usually it is not necessary or expedient to connect more than two or three motors to the same ground connection, for as a general rule the several motors on the one installation are too far apart to warrant this, it being cheaper to make a separate ground connection from each motor to the nearest water pipe or other good ground. A good reason for not connecting more than one motor to the same ground connection is that in case of a charge coming in over one machine and a ground existing in another, the latter machine is liable to be damaged through the ground connection.

It is not considered good practice to ground motors of different voltages to the same ground connection, although the National Electrical Code does not prohibit this. As a general rule this difficulty does not present itself, since different voltages for motor service do not exist on one installation. However, if motors of different voltages are grounded to the one terminal, there is always a chance that the voltage of one machine will be crossed with that of another.—R. L., Detroit, Mich.

[Answers to Questions Nos. 339 and 340 will be published in an early issue.—Editor.]

NEW APPLIANCES

A Weekly Review of the Latest Developments and Current Information Respecting Electrical and Kindred Mechanical Appliances

CHARGING PANEL FOR STORAGE BATTERY FOR OPERATION OF EMERGENCY LIGHTS ON PASSENGER VESSELS.

An Important Provision for Safety at Sea.

In compliance with the regulations of the Steamboat-Inspection Service of the Department of Commerce, requiring auxiliary lights fed from an independent source of power on passenger vessels, a number of such vessels at Baltimore, Md., have been equipped with emergency lights, using the emergency radio storage battery as an auxiliary source of power to operate them. The auxiliary power furnished primarily for the wireless telegraph is thus made to serve two purposes.

In order that the storage battery shall be properly charged, a charging panel has been designed by Radio Inspector R. Y. Cadmus, of the United States Bureau of Navigation, which apparently meets these requirements. The board is so equipped as to disconnect automatically the charging circuit when the battery has been charged. Should the lights be used for purposes other than emergency, the Sangamo ampere-hour meter (which is used to show the amount of current put in or taken out of the storage battery) can be so set as to cut out these lights when the discharge reaches a certain point, thereby reserving the necessary emergency supply.

The board is equipped with overload and underload automatic switches to prevent excessive charging. It is simple in construction and comparatively inexpensive. Should an accident require the use of emergency lights, an officer or wheelman on the bridge throws one switch or presses a push-button on the steering head of the wheel.

Emergency lights are placed in the main passageways; in the passageways leading to the staterooms; over the doors leading to the decks; on the stairways leading to the lifeboat decks; on the boat deck in immediate vicinity of lifeboats and rafts, and the auxiliary current is also connected with the signal lights of the vessel.

The above lights are arranged on three circuits, one for each deck, leading to the charging panel. These circuits consist of two-wire, lead-covered cable. The lamps are connected in parallel, so that should one of the lamps be broken the circuit is not interrupted. On the freight deck three-ampere fuses are used, on the passenger deck five-ampere, and on the boat deck ten-ampere fuses are used. In the event of an accident, should the water reach the freight-deck circuit the lower fuses will blow, allowing the lights on the upper decks to remain in service.

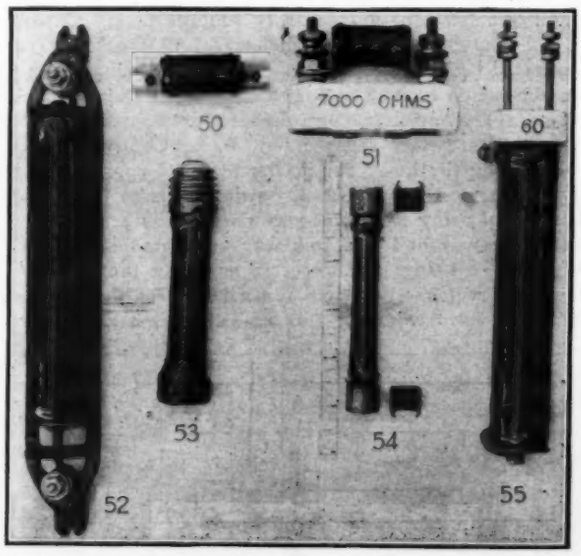
These auxiliary lamps can be so placed as to illuminate the lifeboats, so that in case of accident, light is provided to the last, where most needed.

Ward Leonard Resistance Units for Signal, Telephone and Telegraph Circuits.

The Ward Leonard Electric Company, Bronxville, N. Y., has devoted its attention recently to the task of producing a compact unit of high resistance and moderate current-carrying capacity, combining in a small space the salient features of a strong durable resistance unit for signal, telephone or telegraph circuit. The illustration herewith shows units made of practically zero-temperature-coefficient wire, wound on porcelain tubes, and covered with a vitreous enamel that is said to possess the following advantageous features.

The resistance wire is imbedded in a material which will expand and contract at the same rate as the resistance itself within the limits of usage, thus preventing the adjacent turns from closing together and short-circuiting, thus preventing, therefore, a change in the resistance of the unit which causes a burnout in the circuit. The vitreous enamel in which the wire is embedded and by which it is entirely covered, protects the wire from the atmosphere. As the entire wire is hermetically sealed it cannot deteriorate owing to the action of moisture or other corrosive elements. The coating of enamel over the wire is so thin, and the enamel so good a conductor of heat, that the heat generated is dissipated very rapidly, because the radiating surface is practically increased from that of the fine wire to that of the porcelain tube. The resistance wire has practically zero temperature coefficient, that is, its resistance does not alter with change of temperature, the importance of which is well known.

These units are very strong mechanically, are small, compact, nonabrasive, rustproof, waterproof, fireproof and dustproof. The terminals are very strong, and the connections between the resistance wire and the terminal leads are imbedded in the vitreous enamel, which preserves the joint against any depreciation. The shape is the best possible for mounting, as is evident from the cut, which shows units arranged to be screwed into lamp sockets, equipped with ferrule ends for fuse-clip mounting, equipped with angle ends, standard Railroad Signal Association, signal practice for mounting in standard signal blocks, also especially adapted types for telephone and telegraph service. Any of the units shown can be furnished with resistance as high as 10,000 ohms on one layer.



Samples of Compact Ward Leonard Resistance Units.

Projectors on Skating Pond Casino.

Installations of Flood Lighting by Projectors.

The public skating rink on the lake in Central Park at Schenectady, N. Y., has this winter been illuminated with flood-lighting projectors so this popular sport could be enjoyed during the evening. The projectors were placed on the balcony of the Casino so as to light the skating pond and the toboggan slide in the background. A 500-

Flood Lighting of Skating Pond.

watt Edison Mazda lamp was used as the light source of each projector.

On the evening of March 1, a celebration was held at Plymouth, Mass., to commemorate the opening of a white way consisting of 35 ornamental luminous arc lamps. One feature of the celebration was the illumination of the Court House and the tower of the new Federal building by means of flood-lighting projectors. Ten of these projectors were used to illuminate the Court House, two being installed to light the tower and eight to light the face of the building. As the building has a front built of red brick with white trimmings, the effect was very beautiful as well as strikingly attractive.

In both of these installations projectors made by the General Electric Company were used.

Flood Lighting of Court House, Plymouth, Mass.

Hartman Automatic Switch for Use in Charging Ignition Batteries.

Charging ignition and lighting batteries, such as are used for gasoline automobiles, has come to be an important feature in most garages. Equipment for such charging is now commonly of the motor-generator type. In many such sets a reverse-current circuit-breaker is not provided for protecting the battery from discharging back into the generator in case of failure of line current. To meet this need an automatic switch has been placed on the market

Fig. 1.—Automatic Charging Switch.

by the Hartman Electrical Manufacturing Company, Mansfield, O.

As shown in Fig. 1, it is a compact device, the coil of which is inclosed in the case at the top. The wiring scheme for this switch is shown in Fig. 2. It will be observed that the coil has two windings, one in series with the current from the generator to the battery and the other connected

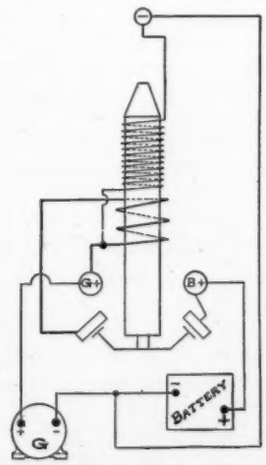


Fig. 2.—Wiring of Automatic Switch.

across the generator terminals. As soon as the charging current fails, the contacts on the switch drop, opening the circuit and preventing discharge at the battery. The shunt coil is so arranged that as soon as the generator again is placed in service and has the requisite voltage for charging, the switch is automatically closed, thus permitting charging to proceed. This shows that the switch is both an automatic cutout and cutin.

The switch includes an adjustable resistance which is put in series with the shunt coil by means of a button and pointer; the latter can be turned to 1, 2, 3 or 4, these numbers indicating the number of six-volt batteries which are to be charged in series at one time. The switch is arranged to accommodate four such batteries or two 12-volt batteries. As many sets of batteries in parallel can be connected to the generator as the latter has charging capacity for. The moving contact of the switch consists of a laminated brush made of thin slotted copper strips. An additional arcing contact is provided, although it is merely as a safeguard because the switch almost invariably opens at no load. This switch is made in three sizes having current capacity of 30, 50 and 100 amperes, respectively.

New Perkins Automatic Door Switch.

The Bryant Electric Company, Bridgeport, Conn., has recently brought out an improved automatic door switch for use on closet doors, hotel-room doors, etc. This new device, known as Perkins automatic door switch, is said to overcome all of the objections existing in previously designed switches of this character.

Compact Door Switch.

The operating button projects only eleven-thirty-seconds of an inch beyond the face plate, whereas in other designs this projection has been as much as five-eighths of an inch or more. The advantage of less projection is important, as the door does not have to be opened so much as formerly to permit the complete operation of button and insure the lighting of lamp. With the new design of shorter button, the required movement of button is also shorter so that the light is "switched off" more quickly. Another great improvement over previous practice, is the use of two screws to hold the plate in position, instead of one, and the fastening of these screws into special ears, independent of the mechanism, instead of to the bracket part of the mechanism itself as was the former practice.

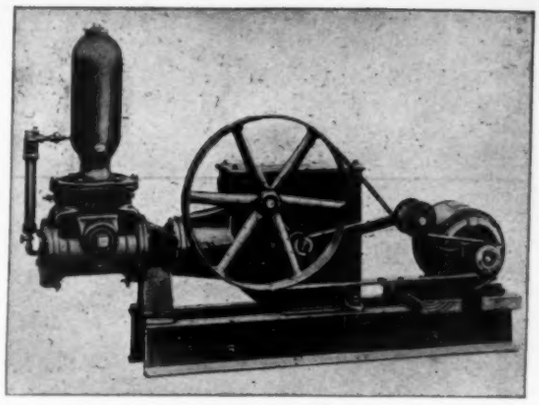
The operating mechanism of this new switch has also been greatly simplified and the parts thereof made larger and stronger. The commutator is of the knife-blade type, well insulated by liberally designed fiber blocks which prevent overheating and eliminate risk of damage or rapid carbonization.

Comparative tests under normal rating (3 amperes, 250 volts) of this type of switch show an average life for the new design of upwards of 100,000 cycles, or approximately ten times the operating life of old-style switches.

This new type of switch can be furnished to either close the circuit when the door is opened or to close the circuit when the door is closed.

A New Electric Shallow-Well Pumping Outfit.

Where electric current is available, the pumping outfit shown will exactly meet the water-supply requirements for bathroom, kitchen and laundry purposes in residences, bungalows and cottages in suburban districts not reached by the city water mains, or where the city or artesian water is hard or otherwise unfit for household use. The manufacturer, the Leader Iron Works, Decatur, Ill., has designed this pump to operate quietly, reliably and with little attention.



Motor-Driven Shallow-Well Pump.

The working parts of the pump are inclosed in a dust-proof case and operate in an oil bath insuring minimum wear and quiet operation. An air chamber is connected in the discharge line of the pump to prevent "pounding" in the lines which also tends toward quiet operation and according to the manufacturer, eliminates bursting or loosening of pipe joints.

The pump is driven by a Westinghouse motor belted to the pump pulley and mounted compactly on channel iron together with the pump so that no special foundations are required.

New Electric Signal Lamp Visible 100 Miles.

E. G. Fischer, chief of the Instrument Section of the Coast and Geodetic Survey, Department of Commerce, has just completed the design and construction of a signal lamp which will be used during the coming summer in the mountainous regions of Idaho and Oregon on primary triangulation where the distance between stations is frequently as much as 100 miles. This lamp has been tested by the Bureau of Standards and is shown to be more than 150 times as powerful as the acetylene signal lamps which have been used for a number of years by the Survey. These acetylene lamps have been observed with the telescope over lines more than 120 miles in length. The new lamp is an electric one, with a specially designed filament, and the power is the ordinary dry cell. While no tests have been made on the field with the new lamp, it is expected that ordinary haze or smoke will seldom prevent observations.

The Bureau of Standards has made careful tests of the new lamp and states that the larger sizes of this lamp are so powerful as to be scarcely comparable with the acetylene lamp.

Close Voltage Regulation Necessary for Heating Units.

In connection with the operation of electrically heated units it is pointed out that 110-volt energy is found best suited where small heating elements are used, because of the larger wires in the windings than those suitable to 220-volt operation. When a factory is being equipped with machines of this type the installation of a separate transformer in connection with heating circuits is found desirable, as variations in voltage due to operation of motors on the same circuits are liable to cause trouble, or at least subject the heating units to a severe test. The current in all cases should be closely regulated to coincide with the indicated voltage of the machine.

A little care in installing the apparatus will result in the saving of time and money in operating this type of apparatus.

INDUSTRY ACTIVITIES

Mountain Electric Company, Denver, Colo., has prepared a mailing folder on the Dostal dropout for protection of lines for overhead crossings.

Wireless Improvement Company, 81 New Street, New York City, has prepared a bulletin on special condensers, and Dubilier mica condensers.

National Conduit & Cable Company, 41 Park Row, New York City, is distributing its latest issue of "Copper Gossip," which gives a review of present conditions in the copper markets.

Standard Underground Cable Company, Pittsburgh, Pa., has issued Bulletin No. 202-1, on "Colonial Copper Clad" wire. Methods of manufacture, specifications and comparisons with other kinds of wire are given.

Roller-Smith Company, 203 Broadway, New York City, has issued Bulletin No. 100, on electrical instruments for signal-system testing, which include direct and alternating-current portable volt-ammeters and direct-reading portable ohmmeters.

Duncan Electric Manufacturing Company, Lafayette, Ind., manufacturer of electric meters and transformers, which established a branch office at 608 Globe Building, Minneapolis, Minn., in January, has experienced a marked increase in sales of its products in that territory.

E. L. Goldschmidt and C. P. Lyman, for a number of years with the Waclark Wire Company, New York City, have resigned and formed a company under the name of Goldschmidt & Lyman, Inc., to conduct a brokerage business in raw metals and manufactured metal products at 90 West Street, New York. Mr. Goldschmidt will handle the raw metal end of the company's business, having had many years' experience in that field, and Mr. Lyman that having to do with manufactured metal products.

The Peerless Electric Company, Warren, O., has issued Bulletin No. 200, describing a new line of repulsion-induction single-phase motors designated as Type R. These motors are self-starting under full load, and upon attaining speed a governor mechanism operates to short-circuit the commutator and lift the brushes. The starting torque is 25 per cent in excess of full-load torque, and the starting current about 2.5 times full-load current, but this value may be reduced by using a starting resistance if desired. These motors are made in sizes from one-sixth to five horsepower, for frequencies from 25 to 133 cycles, and voltages from 90 to 500 volts. The efficiency and power factor are said to be high.

General Electric Company Annual Dinner at Boston.—Nearly 450 central station men, street-railway officials and isolated-plant operators were guests of the General Electric Company at its annual dinner at Boston, which was held at the Copley Plaza Hotel, March 27. Charles B. Davis, manager of the Boston office, presided and acted as toastmaster. The principal speaker was G. M. Dahl, vice-president of the Electric Bond & Share Company, New York City, who reviewed the world situation in connection with the European war and applied its lessons to American business conditions. He urged that business men should take a more active part in government, bringing to bear a strong influence toward making the management of affairs more efficient and economical. Taxation, he said, is one issue that demands careful study. E. W. Rice, Jr., president of the General Electric Company, made introductory remarks. A number of representatives of the Schenectady office were present.

Harvey Hubbell, Inc., Bridgeport, Conn., has issued, under date of March 15, catalog sheets giving trade discounts on Hubbell material in eastern and western territory.

Dayton Electrical Laboratories Company.—Addresses by a number of members of the "Delco Light" sales force, as well as by Messrs. Deeds, Kettering and Grant, officers of the company, enlivened a dinner attended by over 100 salesmen and sales agents on March 24. The new "Delco Light" was the principal subject of discussion, the gathering being calculated to start the selling campaign of the Domestic Engineer Company, which will manufacture the light.

The Economy Fuse & Manufacturing Company, Kinzie and Orleans Streets, Chicago, Ill., is distributing a circular, 18 by 24 inches, containing reproductions of hundreds of re-orders for Economy fuses. One side of the circular contains re-orders from miscellaneous users, showing the large number of important concerns using these fuses. The reverse side contains only reproductions of orders from the United States Navy Department and from the Carnegie Steel Company, practically the entire sheet being filled with these. In the center of the sheet are reproduced letters from various municipal inspection departments approving use of Economy fuses.

Nordberg Manufacturing Company, Milwaukee, Wis., has issued Bulletin No. 27A, on its high-compression, two-cycle oil engines. This engine is said to be one of the simplest oil engines on the market. It is of the two-cycle type, built in three sizes—a single-cylinder, 50-horsepower; a single-cylinder 100-horsepower, and a twin-cylinder, 200-horsepower, running at 300, 270 and 270 revolutions per minute respectively. The engine ignites on its own compression, therefore has no hot head, bulb, torch, or electric ignition devices. The injection of fuel is accomplished directly by a fuel pump driven by an eccentric. A single-piston valve on the cold end, which controls the scavenging air, is the only valve on the engine. The bulletin illustrates the engine by a number of photographs and detail drawings. Power and scavenging cards are also reproduced. Copies will be sent on application to the company.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has received, among the many orders for steel-mill equipment, three from new plants that illustrate clearly the growth of the steel industry in various parts of the country. Equipment sold to the Baltimore Sheet & Tin Plate Company consists of several large motors for main-roll drive; two 1,200-horsepower, 36 to 60-cycle, 2,200-volt, 244-revolutions-per-minute, wound-rotor induction motors, each motor to drive six hot mills, and one 750-horsepower, 36 to 60-cycle, 2,200-volt, 367-revolutions-per-minute, wound-rotor induction motor, geared to 12 standard cold rolls. The Chattanooga Steel Company has purchased equipment for a 34-inch blooming mill, consisting of an 8,000-horsepower motor and a flywheel motor-generator set, which acts as an equalizer. Equipment sold to the Llewellyn Iron Works for their new plant at Los Angeles, Cal., consists of two 800-horsepower, 36 to 50-cycle, 2,200-volt, 730 to 365-revolutions-per-minute, adjustable speed, wound-rotor induction motors, the first to drive a 22-inch billet mill, and the second to be geared to a 12-inch merchant mill, and one 250-horsepower, 585-revolutions-per-minute, 36 to 50-cycle, 2,200-volt, wound-rotor induction motor, to be geared to a 14-inch roughing mill.

LATEST APPROVED FITTINGS

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association

ATTACHMENT PLUGS, Fuseless. —Benjamin Electric Manufacturing Company, 120-128 South Sangamon Street, Chicago, Ill.

Separable and non-separable or composition attachment plugs. Benjamin, 660 watts, 250 volts, catalog No. 919.

Listed February 28, 1916.

ATTACHMENT PLUGS, Fuseless. —R. S. Mueller, 423 High Avenue Southeast, Cleveland, O.

Non-separable attachment plug, consisting of single-piece porcelain body and Edison screw shell. Conductors soldered to screw shell and center contact. Attacho Plug. 660 watts, 250 volts, catalog No. 2.

Listed February 21, 1916.

CABINETS. — Metropolitan Electric Company, 324 First Avenue South, Seattle, Wash.

Cabinets shown by tests and examinations to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.

Listed February 9, 1916.

CARBONATOR, Electric.—The Rud. Mueller Manufacturing Company, 2129 Warner Avenue, Chicago, Ill.

Automatic electric carbonator, consisting of a motor-driven carbonator controlled by an automatic switch actuated by weight of water in tank. Motors are of enclosed type, rated 0.125-horsepower, 110 or 220 volts, alternating or direct current. Designed for use in carbonating water. "Unity."

Listed February 16, 1916.

CONDUIT BOXES.—M. B. Austin, 700 Jackson Blvd., Chicago, Ill., submittor.

Pressed steel conduit boxes, catalog Nos. 2, 4, 5, 7, 7-O, 7 R. B., 9, 9 Deep, 9-E, 9-0, 9-O Extra Deep, 10, 32, 32X, 33, 33X, 34, 34X, 35, 35X, 36, 36X, 37, 37X, 38, 38X, 40, 42, 44, 49-51, 300, 320.

Also above types with steel or porcelain covers or with porcelain bushings.

Listed February 10, 1916.

CONDUIT OUTLET PLATES.— John I. Paulding, New Bedford, Mass.

Cast-iron outlet plates for straight electric outlets. Catalog Nos. 031, 041.

Listed February 16, 1916.

CUTOUT BASES, Cartridge Fuse. —The New Haven Electric Manufacturing Company, North Haven, Conn.

600 amperes, 250 volts; 400 amperes, 500 volts.

Listed February 17, 1916.

INSULATING JOINTS.—E. O. McDowell, 154 Nassau Street, New York, N. Y. Manufacturer, Hemming Manufacturing Company, Garfield, N. J.

McDowell insulating joints.

Insulating joints, shown by tests and examination conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Board of Fire Underwriters have labels attached.

Listed February 23, 1916.

INSULATING MATERIALS.—Formica Insulation Company, 3240-44 Spring Grove Avenue, Cincinnati, O.

A molded insulating material with high dielectric strength; not strictly non-combustible, although somewhat brittle, has moderate mechanical strength. Absorption of moisture is very small and affected little by oils. Suitable for use where a material molded in shapes or flat pieces is desired; in electrical appliances where it will not be exposed to high temperatures, and where a material having the properties indicated above is required for parts or bases of electrical appliances. Formica.

Standard for use as a substitute for hard fiber. This material is also judged suitable for use in small pieces as a support for current-carrying parts when properly enclosed or protected and where the use of strictly non-combustible material is not practical.

Listed February 21, 1916.

PHOTOGRAPHIC PRINTING MACHINE.—Ansco Company, Binghamton, N. Y.

Devices for printing photographs by incandescent lamps, consisting of cabinet with glass top and a hinged cover engaging with a standard door switch. Three sizes. 110 volts, 3.5 amperes or less.

Listed March 9, 1916.

RECEPTACLES, for Attachment Plugs.—Harvey Hubbell, Inc., Bridgeport, Conn.

Surface type, 10 amperes, 250 volts, catalog Nos. 5882-87, 5936-39, 6055-68; three-pole, catalog Nos. 6045-46, 6146; 20 amperes, 250 volts, three-pole, catalog No. 6055.

Flush type, 10 amperes, 250 volts, catalog No. 6257; three-pole, catalog Nos. 6049-50, 6148.

Chandelier type, 660 watts, 250 volts, catalog Nos. 5325, 5732, with porcelain cap; 5326, 5733, with composition cap; 5423, 5734, with brass-covered cap.

Adapters, 660 watts, 250 volts, combining Hubbell plug with Edison shell receptacles, catalog Nos. 5424, 5737, 5897, for use with receptacles rated at 20 amperes, 250 volts.

Angle receptacle adapters combining Hubbell plug with Edison shell receptacles, catalog Nos. 5516-17, 5613.

Motor attachment plugs, 10 amperes, 250 volts, catalog Nos. 5746-47, 6143.

Listed March 1, 1916.

RECEPTACLES, Standard. — Harvey Hubbell, Inc., Bridgeport, Conn.

Hubbell porcelain shell receptacles.

Keyless, 660 watts, 250 volts, catalog Nos. 4103, 9402, 28795, 50715.

Listed March 1, 1916.

SIGNS Electric.—Brilliant Manufacturing Company, 1035 Ridge Avenue, Philadelphia, Pa.

Electric signs shown by tests and examinations by Underwriters' Laboratories to be in accordance with the requirements of the National Board of Fire Underwriters have labels attached.

Listed February 21, 1916.

SIGNS, Electric. — Brilliant Sign Company, 420 North Eighth Street, St. Louis, Mo.

Electric signs shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with the requirements of the National Board of Fire Underwriters have labels attached.

Listed February 25, 1916.

SOCKETS, Standard.—Harvey Hubbell, Inc., Bridgeport, Conn.

Hubbell porcelain shell sockets.

Key, 250 watts, 250 volts, catalog Nos. 3332-33, 3337, 3381, 3388.

Listed March 1, 1916.

SOCKETS, Weatherproof. — The Bryant Electric Company, Bridgeport, Conn.

Bryant or Perkins, 660 watts, 250 volts.

Porcelain shell with aluminum casing, catalog Nos. 4106-07.

Listed March 1, 1916.

TRANSFORMERS.—The Jefferson Electric Manufacturing Company, 847 West Harrison Street, Chicago, Ill.

Bell-ringing transformer. Jefferson Junior. High-voltage, 110; low-voltage, 8.

Standard only for ringing bells or for similar signaling work when the primary wiring is installed in accordance with Class C of the National Electrical Code.

Listed February 21, 1916.

WIRES, Miscellaneous.—D. & W. Fuse Company, Providence, R. I.

Deltabeston stove wire.

Solid copper conductors of Nos. 14 to No. 6 B & S gauge, insulated by an unfilled felted asbestos over which is an outer braided asbestos.

Standard for use in wiring electric heaters, ranges, stoves, ovens and similar appliances.

Listed March 7, 1916.

PERSONAL AND BIOGRAPHICAL

DR. M. I. PUPIN, professor at Columbia University, New York, was instrumental in arranging for a meeting held at Philadelphia on March 29 for the purpose of raising funds for the Serbian war suffers. Professor Pupin, who is well known for his inventions of the Pupin coil and other electrical devices, is the Serbian Consul General at New York and the only diplomatic representative of Serbia in the United States. Professor Pupin was born in Austria, in 1858, and came to this country in 1874. He attended school at Adelphia Academy. At the end of two years he was graduated with honors and was soon afterwards made the recipient of a scholarship at Columbia University, which institution he entered in 1879. Professor Pupin was next accorded a fellowship in Columbia and this enabled him to take a post-graduate course at Cambridge University, England, and at the University of Berlin, Germany. In 1889, Professor Pupin returned to Columbia and was appointed instructor of mathematical physics in the department of electrical engineering. His subsequent researches have been chiefly in the domain of electricity, particularly in the matter of electric-wave propagation. In February Professor Pupin was awarded the Hebert prize by the Academie des Sciences de l'Institut de France for his research work.

M. I. Pupin.

MR. L. EDWARD HERRMANN, Trenton, N. J., has been appointed counsel of the Board of Public Utility Commissioners by Governor Fielder, succeeding MR. FRANK H. SOMMER, resigned.

MR. H. M. BYLLESBY, president of H. M. Byllesby & Company, Chicago, was toastmaster at the annual banquet of the Illinois Gas Association, held at Hotel Sherman March 23. During the course of the evening Mr. Byllesby made an address upon the need for business rather than political regulation of utility companies.

MR. E. H. KIFER, who has been connected with the Madison (Wis.) Gas & Electric Company for the past ten years and as general superintendent for the past five years, has accepted the general managership of the Binghamton (N. Y.) Gas Company. The American Light & Traction Company controls both companies.

MR. GEORGE C. BOWEN, of the sales force of the Northwestern Electric Company, of Portland, Ore., has been promoted to the position of assistant sales manager, succeeding to the position made vacant through the resignation of MR. W. H. P. HILL. Previous to his employment by the Northwestern Electric Company, Mr. Bowen was employed by the Pacific States Electric Company and the Dedrick Electric Company.

MR. G. M. WELCH, who was recently promoted from the position of commercial superintendent of the Michigan State Telephone Company, Detroit, Mich., to the general managership, entered the telephone business ten years ago. Resigning a position as city salesman for the Eagle White Lead Company, Chicago, Ill., Mr. Welch entered the employ of the Northwestern Telephone Exchange Company, Minneapolis, Minn. After a short time he was made assistant to the general manager, continuing to act in that capacity till September, 1908, when he went to Detroit as division contract agent of the Michigan State Telephone Company. Following a short residence in Detroit, Mr. Welch was transferred to Chicago to assume the duties of commercial agent for Ohio, Indiana, Illinois, Wisconsin and Michigan, the states comprising what is known as the Central Group of Bell Companies. In 1912 he was again advanced, being returned to Detroit to become commercial superintendent of the Michigan State Telephone Company. Mr. Welch is extensively interested in the telephone business in Michigan, being a director of several telephone companies operating in the state. He took active charge of the Bell Company's business in Michigan March 5.

G. M. Welch.

MR. THEODORE N. VAIL, president of the American Telephone & Telegraph Company, and head of the entire Bell Telephone System in this country, was the principal speaker at the annual banquet of the National Geographical Society at Washington, D. C., on March 7. Some interesting reminiscences were recounted by Mr. Vail in his address which dealt mainly with the trials and tribulations of successfully establishing the telephone in this country. Mr. Vail said, "As general superintendent of the Railway Mail Service, I was brought into intimate personal contact with Mr. G. G. Hubbard, who was the chairman of a commission created by Congress to investigate and report upon the then aspects of the controversies over the compensation of railroads for transporting the mails. On the trips of the commission over the country, Mr. Hubbard carried with him a few telephones and without neglecting the work of the commission, he at every opportunity exhibited and explained this marvelous invention. We discussed the business, its possibilities and potentialities, and the policies which should underlie its development, so that my connection with the telephone may be said to date from its inception."

T. N. Vail.

OBITUARY.

MR. J. HENRY CARSON, who, as general manager of the Sterling-Meaker Company, was for many years interested in the manufacture of electric-railway supplies, died March 30, at his home in New York City, aged 52 years. Mr. Carson recently accepted the vice-presidency of the Pan-American Munitions Corporation, of New York.

MR. CHARLES WARREN BASSETT, who established the electrical-wire department of the old Washburn & Moon Company in Worcester, Mass., 25 years ago, died at his home in Boston, Mass., March 31, aged 73 years. Mr. Bassett was manager of that department, continuing after the concern was absorbed by the American Steel & Wire Company.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

BIDDEFORD, ME.—Mayor J. H. Fenderson is considering a proposition to install an ornamental lighting system on Main Street.

CORNISH, ME.—The Cumberland County Power & Light Company, A. H. Ford, president, has begun work preparatory to the erection of a dam and generating station at Hiram Falls. The dam will be built about half way down the falls, which have a drop of 60 feet in a distance of 900 feet. The top of the dam will be about six feet above the level at the head of the falls, and a penstock will be run to the foot of the falls on the Baldwin side, where the power house will be erected. Machinery to generate 6,000 horsepower will be installed during the summer and provisions made for an ultimate capacity of 20,000 horsepower. The power developed will be used in Portland and intervening communities. The cost of the development is estimated at $500,000.

CONCORD, N. H.—East Concord is to be included in the street lighting district and electric lights will be installed on the principal streets.

MONTPELIER VT.—The Waterbury Light & Power Company, with its properties and franchises, is to be acquired by the Montpelier & Barre Light & Power Company, the latter to assume all outstanding obligations, including the first mortgage bonds amounting to $105,000. The Vermont Public Service Commission has approved the transfer. Charles H. Tenney & Company, Boston, Mass., are the managing engineers of the Montpelier & Barre Company.

BOSTON, MASS.—The Boston & Eastern Electric Railway Company has asked for an extension of three years' time in which to file their bond preliminary to building a railway between Boston and Lynn, Danvers and Beverly, Mass. It is stated that the company has already spent $250,000 in engineering and projecting the line, which will involve the expenditure of several millions of dollars.

MILFORD, MASS.—The power business of the Milford Electric Light & Power Company is rapidly increasing, and a new substation is being built to take care of the present and future demands.

NORTHAMPTON, MASS.—The Northampton Electric Light Company plans to install a new 2,000-kilowatt turbogenerator to meet the growing requirements of the city.

STOCKBRIDGE, MASS.—The Stockbridge Lighting Company is making preparations for an extension to its lines in West Stockbridge.

BRIDGEPORT, CONN.—Extensions of the white way on Main Street, which include 11 additional ornamental posts, are being planned by the Council.

CROMWELL, CONN.—The Connecticut Power Company has been granted permission by the Council to erect an electric power plant here. The company plans to build a steam generating plant here which will be connected with its plants at Falls Village and Middletown.

PLAINFIELD, CONN.—The Danielson & Plainfield Gas & Electric Company is planning to extend its lines to the villages of Attawaugan, Ballouville and Pineville, to furnish lighting and power service. Additional generating equipment probably will be installed in the Plainfield plant.

RICHMOND, MASS.—City officials are considering the application of the Pittsfield Electric Company for permission to extend its transmission lines to furnish power and light to this city.

BUFFALO, N. Y.—J. E. Mulroy and other residents of the South Side are making plans for improved lighting in that section of the city.

COHOES, N. Y.—An extension of the ornamental lighting system in the business district will probably be made in the near future. The Cohoes Electric Lighting Company is preparing to equip a number of knitting factories here with electric drive to replace hydraulic power.

DUNKIRK, N. Y.—The Niagara & Lake Erie Power Company, of Fredonia, has renewed its application to supply electrical energy in this city. City officials are adverse to granting any franchise affecting the value and future of the municipal plant, but the franchise will probably be granted in order to supply the needs of the Atlas Steel Company, which is seeking additional power facilities.

NORTHPORT, N. Y.—The Long Island Lighting Company is making improvements in its generating plant here. A reduction in lighting rates has been made and demands for more energy will necessitate extensions.

NYACK, N. Y.—The Rockland Light & Power Company, E. C. Peebles, manager, has received the approval of the Public Service Commission for an issue of $200,000 in capital stock. Extensions and improvements are planned.

OLEAN, N. Y.—The Public Service Commission has approved an issue of $126,000 in bonds and $33,000 in capital stock by the Olean Electric Light & Power Company. The proceeds will be used for extensions to the generating equipment and distribution system.

ST. MICHAELS, MD.—The Town Commissioners are planning to construct a municipal electric lighting plant.

ORANGE, VA.—H. O. Lyne is planning to install an electric-lighting plant here.

PETERSBURG, VA.—The tract occupied by Riverside Park is to be improved, and an ornamental lighting system and service mains will be installed.

DILLON, S. C.—The City Commissioners have completed plans for establishing 24-hour service for electric lighting and power.

SPARTANBURG, S. C.—The Interborough Power Company, of Spartanburg, with a capital stock of $100,000, has been commissioned by the secretary of state, with the following Spartanburg men as petitioners: A. M. Law, R. E. Boggs, C. R. Willard and W. G. Willard. The company was formed for the development of Hill's shoals on Tiger River, 16 miles south of Spartanburg, where there is said to be a possible development of 3,000 horsepower.

SUMMERTON, S. C.—The local electric lighting plant was destroyed by fire recently. Plans for rebuilding are being made.

TYBEE, GA.—The Central of Georgia Railway is planning to install an electric pumping plant here. Two 20,000-gallon water-storage tanks will be erected.

JACKSONVILLE, FLA.—The Liquid Carbonic Company will build a $50,000 plant here. A. E. McLean, Atlanta, Ga., is southern manager of the company.

NORTH CENTRAL STATES.

CANTON, O.—Two buildings, to cost about $50,000 each, will be constructed by the Canton Electric Company and allied companies in connection with contemplated expansion. One will be a garage with some shop equipment, and the other a substation with transforming equipment to handle the high-tension current from the American Gas & Power Company for use in the city.

CINCINNATI, O.—A considerable amount of electrical equipment will be required in the construction of the medical college building of the Cincinnati General Hospital, contract for which has been awarded to the Westlake Construction Company, of St. Louis, on its bid of $250,000. No power plant will be required.

CINCINNATI, O.—Stockholders of the Cincinnati Gas & Electric Company have formally voted their approval of the plans of the company, in connection with the Union Gas & Electric Company, to issue bonds and construct a power plant on the river front in Cincinnati, to serve this entire district. Bonds to the amount of $15,000,000 will be authorized, of which $4,500,000 will be issued at once to finance the power plant, and as soon as the approval of the Ohio Public Utilities Commission is secured ground will be broken for the building.

COLUMBUS, O.—The Northwest Ohio Light Company has acquired the Hicksville Electric Light, Heat & Power Company and several independent transmission lines connected with it, for use in its plan for the extension of electrical service to numerous small towns in that territory.

SPRINGFIELD, O.—The lighting and power system of the new Memorial Hall, to be built by the County Commissioners, will be installed by the Springfield Light, Heat & Power Company, which will also furnish service. The same company is negotiating with the Caldwell-Marshall company for similar contracts on the Hotel Shawnee.

SPRINGFIELD, O.—Electrical equipment for lighting, power and other purposes connected with the repair shop and general work of a large garage will be required by T. A. Graham in the construction of a building for Trout & Anderson here.

SOMERVILLE, O.—A franchise to furnish electric service here and a contract for lighting the village streets has been awarded to an outside company.

YOUNGSTOWN, O.—H. W. Jones, city lighting engineer, has prepared plans for lighting systems for Lincoln and South Side Parks. These will be considered by the Park Commissioners and may be installed this year.

ZOAR, O.—The Zoar Electric Company has been organized by John Bimeler and others with a capital of $10,000 for the purpose of furnishing electric service here.

COLUMBUS, IND.—A movement has been inaugurated by the East Columbus, Ind., social center to provide for an electric lighting system and other community improvements. The suburb has more than 2,000 residents.

COLUMBUS, IND.—The Columbus, Greensburg & Richmond Interurban Railway Company is being reorganized. It is planned to begin work in the near future. August M. Kuhn, 2014 North New Jersey Street, Indianapolis, Ind., is president of the company.

ELKHART, IND.—M. D. Franey, master mechanic of the New York Central shops here, states that work on the company's new power house will be started in a few weeks. Estimated cost of the plant is $20,000.

MADISON, IND.—The Public Service Commission of Indiana has granted the Madison Light & Railway Company permission to issue $13,000 in securities, proceeds of which will be used for improvements in its power plant.

BOYNE CITY, MICH.—The Boyne City Electric Company has recently completed the installation of a 75-kilowatt generator and auxiliary equipment.

ALBANY, ILL.—A stock company, of which Charles Peck is president, has been organized to establish an electric lighting system here.

DUPO, ILL.—The Dupo Electric Light & Power Company has been incorporated with a capital stock of $5,000, to furnish electric light and power here. The incorporators are: J. L. Burnett, L. J. Dyroff and W. A. Schwartztauber.

NORMAL, ILL.—Agitation for a municipal electric lighting plant in Normal has been started, and the movement may take definite form during the summer.

SHABBONA, ILL.—An electric lighting system will be installed here. Present indications are that the service will be secured from the Illinois Northern Utilities Company, which may buy the plant at Pawpaw and extend its transmission lines from Earlville to that city and then to Shabbona and Waterman.

DELAVAN, WIS.—The United Heat, Light & Power Company is planning to construct a transmission line around the north and south shores of Delavan Lake.

MADISON, WIS.—Merchants and residents on University and Gilman Avenues

are circulating petitions calling upon the Council to extend the new ornamental lighting system to these thoroughfares.

MERRILL, WIS.—The Wisconsin Valley Electric Company's power line between this city and Wausau is rapidly nearing completion.

SHARON, WIS.—Damage to the extent of $10,000 was done to the municipal water, gas and electric plant by an explosion which occurred last week.

SPOONER, WIS.—G. S. Williams, consulting engineer, 134 South La Salle Street, Chicago, Ill., has been engaged to prepare plans for a hydroelectric development here.

COLOGNE, MINN.—An electric lighting and power plant will be installed here before May 1.

HARTLAND, MINN.—Bonds have been voted for the construction of a municipal electric lighting plant.

ST. PAUL, MINN.—J. P. Garvey, 1230 Thomas Street, is president of the West Thomas Street Improvement Association, which is planning a new electric lighting system.

CEDAR RAPIDS, IOWA.—The Iowa Railway & Light Company has begun the construction work on its new power house, to be built on North First Street.

FAIRFIELD, IOWA.—The City Council has passed an ordinance granting a 20-year franchise to the Fairfield Public Service Company, and it will be submitted to the voters of the city at the election April 10.

PERRY, IOWA.—The Iowa Railway & Light Company, owners of the local electric light and heating plant, have made definite announcements of plans for the construction of a new power plant, to be erected here during the coming summer, to cost about $100,000. Perry will be made the hub of the district, which includes the towns of Rippey, Grand Junction, Dana, Paton, Bouton, Woodward and Coon Rapids, and the power for those towns will be generated here and transmitted over high-tension lines. Other towns will be added to the list as soon as the plant is built. Work on the new plant will begin in a few weeks.

RANDOLPH, IOWA.—An election will be held April 10 for the purpose of voting $4,500 bonds to secure electric service here.

ROCK RAPIDS, IOWA.—About $25,000 will be expended for improvements to the electric-lighting system and waterworks.

WEBSTER CITY, IOWA.—The Fort Dodge, Des Moines & Southern Interurban Railway Company has purchased the Crooked Creek Railroad, and will electrify it and make connections with interurban railway at Fort Dodge.

MEMPHIS, MO.—Bonds in the sum of $25,000 have been voted for the purpose of constructing an electric lighting and power plant here.

ROCKVILLE, MO.—Plans are being discussed for establishment of an electric lighting plant.

ST. LOUIS, MO.—The Union Electric Light & Power Company has completed plans for the addition of five stories to its building at Twelfth and Loomis Streets, at a cost of $250,000. The building, when completed, will be ten stories, and will contain the general offices, sales, engineering, accounting and various other departments of the company. Arrangements are being made for flood-lighting the building.

ASSARIA, KANS.—The Assaria Light & Power Company has been organized with a capital of $3,000, to furnish electric service here.

BLAIR, KANS.—Ways and means are being considered by city officials for securing an electric lighting plant.

DIGHTON, KANS.—A combined electric lighting and water system may be installed here. W. B. Rollins & Company, Kansas City, Mo., are preparing the plans.

FORD, KANS.—The Midland Water, Light & Ice Company, of Dodge City, Kans., has received the first shipment of steel poles to be used in the construction of an electric line between Ford and Dodge City, and work on the new line is now under way.

GARDEN CITY, KANS.—It is reported that the electric lighting plant at Marsh, Kans., which was recently damaged by fire, will be taken over by the Garden City municipal plant. A transmission line will be erected to connect the two plants if present plans materialize.

LANGFORD, KANS.—The Council is planning ways and means to secure electric-lighting service here.

MEADE, KANS.—Improvements to the local electric lighting plant are now being made. These include additional generating equipment and a new building to house the same.

ROSSVILLE, KANS.—The R. B. Fegan Lighting Company, of Junction City, has secured a franchise to install an electric lighting plant here, and work on the installation will begin soon. The Fegan company will install systems this spring at Dwight, Riley and Harveyville.

WICHITA, KANS.—Bids will be received April 17 for the erection of a four-story telephone building for the Missouri & Kansas Telephone Company. L. F. Duggan is district commercial superintendent.

SCOTT CITY, KANS.—J. W. Lough, state irrigation commissioner of Kansas, has completed contracts for the installation of a $50,000 electric pumping plant to irrigate his 5,000-acre ranch near here. The material for the construction of the plant has been purchased, and the plant will be completed by June 1.

SCOTTS BLUFF, NEB.—The Intermountain Railway, Light & Power Company, of Colorado Springs, Colo., has completed negotiations for the purchase of the electric power plant here. The company owns the plants in Laramie, Wyo., Lamar and Los Animas, Colo., and Crawford and Holdridge, Neb. Among the transmission lines to be erected during the summer is one from Lamar to Wiley, Colo. E. C. Van Diest is president of the company.

SUPERIOR, NEB.—The electric lighting plant of the Southern Nebraska Power Company was entirely destroyed by fire recently.

SIOUX FALLS, S. D.—A petition is being circulated here calling for the issuance of $350,000 in bonds for the construction of a municipal electric lighting plant.

HAZELTON, N. D.—The local electric lighting plant is planning to make additions to its generating equipment.

MARMARTH, N. D.—W. R. McKenzie, proprietor of the Bowman Electric Light & Power Company, Bowman, N. D., will install an electric lighting plant at Marmarth this spring. A 25-year franchise has been secured.

DATES AHEAD.

American Society of Mechanical Engineers. Spring meeting, New Orleans, La., April 11-14. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York City.

American Electrochemical Society. Semi-annual meeting, Washington, D. C., April 27-29. Secretary, J. W. Richards, Lehigh University, South Bethlehem, Pa.

Iowa Section, N. E. L. A. Annual meeting, Dubuque, Iowa, May 10-12. Secretary, W. H. Thompson, Jr., Des Moines, Iowa.

Missouri Association of Public Utilities. Annual convention, May 11-13, on board boat leaving St. Louis, May 11. Secretary, F. D. Beardslee, 315 North Twelfth Street, St. Louis, Mo.

Southwestern Electrical and Gas Association. Annual convention, Galveston, Tex., May 17-20. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

National Electric Light Association. Annual convention, Chicago, Ill., May 22-26. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York City.

Arkansas Association of Public Utility Operators. Annual convention, Little Rock, Ark., June 6-8. Secretary, R. B. Fowles, Pine Bluff, Ark.

National Electrical Contractors' Association of the United States. Annual convention, Hotel McAlpin, New York City, July 18-22. Secretary, G. H. Duffield, 41 Martin Building, Utica, N. Y.

SOUTH CENTRAL STATES.

ASHLAND, KY.—Ashland business men have filed incorporation papers for the Ashland-Greenup Traction Line. It is proposed to build a trunk line railway between Ashland, Russell and Greenup, a distance of 11 miles. C. W. Means is interested in the project.

BEREA, KY.—Berea College has purchased two Westinghouse turbogenerators, switchboard and motors to change its entire equipment and power plant from direct to alternating current.

ELIZABETHTOWN, KY.—The Horse Cave (Ky.) Light & Ice Company has been incorporated with $25,000 capital, resulting from amalgamation of the Horse Cave Light Company, owned by J. P. Todd, of Elizabethtown, and the Horse Cave Ice Company. Besides Mr. Todd, the incorporators include C. F. Smith, A. Vial, L. Hawkins and W. C. Davis, all of Horse Cave.

MURRAY, KY.—On May 20 the question of issuing $20,000 electric lighting bonds will be submitted to vote.

BRISTOL, TENN.—The Davis Hosiery Mills Company, of Chattanooga, will build a plant at Bristol to cost about $200,000. It will be operated with electric drive. G. H. Miller is president of the company.

CHATTANOOGA, TENN.—A white way will be established on Ninth Street, from Chestnut to A Streets, and will be completed about May 1.

JACKSON, TENN.—The Illinois Central Railroad Company is making improvements to the amount of $200,000 here, including a power plant.

BIRMINGHAM, ALA.—With a capital of $5,000 the Birmingham Interurban Development Company filed articles of incorporation, the purposes of the company being to build an electric railroad from Birmingham to the Warrior River and Jasper, by way of Dora and Cordova. W. W. Shortridge is secretary.

BOONEVILLE, MISS.—J. K. Kaye, of Okolona, Miss., has purchased the local electric lighting plant and will make improvements.

GOODMAN, MISS.—The city will issue $5,000 in bonds to construct an electric lighting plant.

FORT SMITH, ARK.—The Fort Smith Light & Traction Company is planning extensive improvements to its generating equipment and lines, to be made during the coming summer.

GLENMORA, LA.—S. Farmbacher, of Baton Rouge, and P. Joseph and L. Levy, of White Castle, are to erect an electric lighting plant here at an estimated cost of $12,000.

VERDEN, OKLA.—The Town Board has granted a 25-year franchise to the Chickasha Gas & Electric Company, to furnish electric service here, subject to the approval of the voters. A ten-mile transmission line would be necessary for the purpose.

BIG SANDY, TEX.—The Big Sandy Electric Light Company has purchased land for a new power plant. Some of the machinery in the present plant will be used, but a number of improvements are being planned.

CUERO, TEX.—Plans are being made for an ornamental lighting system here.

DENTON, TEX.—The municipal ornamental lighting system here will be extended.

HOUSTON, TEX.—Plans for a white way on Texas Avenue are nearly completed. An agreement has been made with the Texas Lighting & Power Company whereby that company will install the ornamental lamps.

KENEDY, TEX.—The Kenedy Light & Power Company has been incorporated here with a capital stock of $10,000, for the purpose of building and operating an electric light and power plant by E. B. Fehrenkamp, M. A. Naecher and others.

KNOX CITY, TEX.—The Haskell (Tex.) Light & Ice Company is constructing a high-tension power line to Knox City, for the purpose of furnishing the town with light and power. The line will be 42 miles long.

SHINER, TEX.—The Council is considering plans for constructing an electric-lighting plant.

WESTERN STATES.

MILES CITY, MONT.—The Miles City Hospital will receive bids until April 15 for the construction of a hospital and power house and equipment of power house. Plans and specifications may be obtained at the Miles City Chamber of Commerce.

MAGDALENA, N. M.—The electric light and power plant of the Magdalena Electric Light Company has been purchased at receiver's sale by George Keith and Edward Wayne, of Socorro, N. M. The new owners will make improvements to the plant.

ORGAN, N. M.—Phelps, Dodge & Company, of New York, who recently purchased the Bennett-Stephenson and other mines in the Organ district for a total consideration of $1,500,000, plan to build an electric power plant and make a number of other improvements.

SALT LAKE CITY, UTAH.—The County Commission has voted to give the Utah Power & Light Company permission to extend its transmission lines from Midvale to the West Jordan district to supply power to

the new sugar factory and light to the residents.

BOISE, IDAHO.—A movement is under way to organize a company to construct an electric railroad from Boise to Bruneau and Wickahoney.

HAILEY, IDAHO.—Several improvements, including gates, repairs to reservoir, etc., are to be made in the immediate future by the Hailey Electric Company.

MULLAM, IDAHO.—The Carney Copper Company is negotiating for electric power.

POCATELLO, IDAHO.—The Pocatello Traction & Interurban Company has been granted a franchise to construct a street railway.

WALLACE, IDAHO.—The Reindeer Queen Mining Company has recently reached an agreement with the Carney Copper & Carbonate Hill Mining Company whereby the Reindeer Queen will install a power plant and supply electric current to operate compressor plants, and other equipment of the three mining companies. The plant, it is understood, will be installed on Willow Creek, where the Reindeer Queen owns a water right.

ELLENSBURG, WASH.—The sale of the $100,000 electric light utility bond issue to the Sidney-Spitzer Company, of Toledo, O., has been ratified by the City Council.

OLYMPIA, WASH.—Ordinances have been filed cancelling three franchises for an electric lighting plant, electric lighting and steam heating given to Wilbur B. Foshay, Portland, Ore. The agreement to start work on the proposed plant was not fulfilled.

SEATTLE, WASH.—The installation of the necessary underground ducts for the underground system of wiring on Yesler Way from Western Avenue to Fifth Avenue has been completed by the city lighting department, and Superintendent Ross states the underground cable, transformers, and other necessary equipment will be placed underground in this section as soon as the materials are purchased.

SHELTON, WASH.—The plant of the Shelton Electric Company has been purchased by Charles A. Harmony, former city electrician of Centralia, Wash., who has changed the name of the plant to the Shelton Light & Power Company. The plant, at the present time, has a capacity of 150 horsepower, which, it is reported, will be increased.

SPOKANE, WASH.—Judge George Turner, president of the Constitution Mining & Milling Company, of Spokane, reports the company has under contemplation the construction of an electric smelter in Spokane for the treatment of zinc ores. Experts have estimated the cost of a plant capable of handling 100 tons per day at $425,000. The proposed plant would develop about 600 horsepower.

SUMPTER, ORE.—To insure continuous telephone service between Sumpter and Austin, 30 miles of telephone wire is to be strung between the towns, on the poles of the Pacific Telephone & Telegraph Company, by the United States Government.

WALDPORT, ORE.—L. H. Evans has been granted a franchise to operate an electric-lighting and power plant here.

EL CAJON, CAL.—The Board of Trustees has ratified the engineer's report submitted recently, containing plans and specifications of the proposed district to be assessed for the maintenance of an electric-lighting system, and has set the time for hearing protests in relation to the proposed improvement for April 10.

FRESNO, CAL.—The Fresno Interurban Railway Company is asking the Railroad Commission for authority to issue $150,000 bonds and $60,000 of stock to cover the cost of construction of a main line to the Centerville citrus district and to issue $150,000 certificates of indebtedness at 6 per cent.

MADERA, CAL.—The San Joaquin Light & Power Company is spending over $20,000 on extensions in the Raymond, Knowles and Coarse Gold districts of Madera County. Two new substations are being put in by the company, one at Knowles and the other at Coarse Gold. The Coarse Gold station is being put in for the operation of the mines, and will, it is expected, also serve the town in the near future. The Knowles station will serve the quarries, and a 10,000-volt line is being run to Raymond to serve the town, which has never had electric service.

MODESTO, CAL.—The County Supervisors have ordered the formation of the Hughson New Lighting District.

OROVILLE, CAL.—The sale of the Oro Electric Corporation of this city to the Pacific Gas & Electric Company has been announced as a probability of the near future. The transfer of ownership is expected to be made within six weeks if the plans made by officials of both companies at a conference here are carried out.

REDDING, CAL.—The California-Oregon Power Company, operating in Shasta County, Cal., and Southern Oregon, has applied to the California Railroad Commission for authority to operate as a public utility under the franchise granted it by Trinity County in January, 1915. This franchise gave the company the right to run its lines through parts of Trinity County, and the transmission lines now extend as far as Castella, Shasta County, from which point it is desired to extend them through Carville to Trinity Center.

RIVERBANK, CAL.—Ways and means are being considered for a new electric-lighting system.

SAN FRANCISCO, CAL.—Soliciting subscriptions for the lighting of Market Street was begun in earnest the past week with the distribution of folders among the property owners and merchants along Market Street detailing the benefits that would accrue from the proposed system. Merchants are being asked to contribute $2 a foot toward the project.

TURLOCK, CAL.—Engineer Meikle has submitted to the Turlock Irrigation Board a preliminary estimate of the cost of producing power in the district for drainage purposes which totals $169,000.

VENTURA, CAL.—The City Trustees have appointed a committee to investigate the feasibility of municipal ownership of the local electric-lighting system.

WOODLAND, CAL.—J. W. Coons, local manager of the Pacific Gas & Electric Company, is co-operating with the City Board of Trustees in planning an improved lighting system here.

New Incorporations

HILLSBORO, ILL.—Saline Electric Company. Capital stock increased from $2,500 to $25,000.

CARSON CITY, NEV.—Static Electrical Company. Capital, $10,000,000. Incorporators: William Muller, P. E. and J. G. Ellis.

ST. LOUIS, MO.—Doxsee Electrical Company. Capital, $10,000. General electrical business. Incorporators: A. S. Doxsee and others.

PROVIDENCE, R. I.—Peerless Electric Company. Capital, $10,000. Electrical contracting and supplies. Incorporators: A. A. Drabble, E. W. Ham, Paul Fielden and O. F. Ham.

NEW YORK, N. Y.—Cadillac Electric Company. Capital, $5,000. Incorporators: J. D. Vance, G. J. Van Mater and A. Vance, all of 824 St. Nicholas Avenue, New York City.

BIRMINGHAM, ALA.—Alabama Transportation & Development Company. Capital, $2,000. Build and operate transportation lines. Incorporators: W. S. Bell, S. J. Erckert and others.

WORCESTER, MASS. — Star Electric Company. Capital, $10,000. Electrical manufacturing and contracting. Incorporators: A. A. Drabble, E. W. Ham, Paul Fielden and O. F. Ham.

NEW YORK, N. Y.—Whiteside & Company. Capital, $50,000. Electrical dental apparatus, dynamos, etc. Incorporators: R. W. Schuette, C. F. Novotny and A. A. Meschutt, 5 Nassau Street.

NEW YORK, N. Y.—Electric Directory Company. Capital, $75,000. Manufacture electric device known as "The Electric Directory" and other appliances. Incorporators: H. Straus, P. Heygel and M. C. Weller.

JERSEY CITY, N. J.—Electric Liquid Operator Company. Capital, $50,000. Manufacturing electric signs. Incorporators: A. E. Williams and John Blohm, of Jersey City, and C. H. Blohm, of Palisades Park, N. J.

NEW YORK, N. Y.—Bartlett-Yates Insulation Company. Capital, $10,000. Electrical supplies, insulating materials, etc. Incorporators: H. N. Bartlett and E. L. Bartlett, 312 Park Street, Westfield, N. J., and John S. Yates, 381 West End Avenue, New York City.

Financial Notes

March earnings of Boston Elevated will show an increase in gross of $3,000 per day or better than $90,000 for the month.

Columbia Railway, Gas & Electric Securities Corporation, series "B," convertible six-per-cent secured notes have been called for payment on April 1, at 101 and interest.

Kings County Electric Light & Power Company has certified to the Secretary of State at Albany, N. Y., that its capital stock has been increased from $14,000,000 to $16,500,000. This increase is to take care of the $2,500,000 of the company's bonds which became convertible on March 1.

Marconi Wireless Telegraph Company of America, in its annual report for year ending December 31, 1915, shows income from investment of surplus funds, $87,010.01; interest on stock subscription, $17,922.96; net profits for the year, $177,316.51, an increase of 18.3 per cent over 1914; surplus, $541,887.52, and reserve set aside against depreciation, $373,415.34.

American Public Utilities Company has sold to Philadelphia bankers $1,600,000 20-year secured bonds which are being offered at 98 and interest. The new bonds are secured by the deposit of common stocks of subsidiary companies and the authorized issue is $3,500,000, of which $900,000 are reserved to retire $900,000 six-per-cent notes maturing March 1, 1918, and $1,000,000 for future corporate requirements.

Alabama Power Company, a subsidiary of Alabama Traction, Light & Power Company, has sold to New York bankers $4,000,000 first mortgage, 30-year five-per-cent bonds due March 1, 1946. Proceeds of the bonds, which are the first sold under an authorized mortgage of $100,000,000, will be used to retire the $2,000,000 first mortgage three-year six-per-cent bonds due February 1, 1918, to retire two small issues of divisional bonds and for extensions, improvements and additions to the generating and transmission systems of the company. Earnings of the company for the 12 months ended February 29, 1916, were $1,029,768 gross, with $607,306 net.

Dividends.

	Term	Rate	Payable
Asso. Gas & Elec., pf.	Q	1.5 %	Apr. 15
Boston Sub. Elec., pf.	Q	$1	Apr. 15
Edison, Boston	Q	$2	May 1
New Eng. Pw., pf.	Q	1.5 %	Apr. 15
Niagara Falls Pw.	Q	$2	Apr. 15
No. States Pw., pf.	Q	1.75%	Apr. 15
Ottumwa Ry. & St., pf.	Q	1.75%	Apr. 15
Pac. Gas & Elec., com.	Q	1.25%	Apr. 15
Pub. Serv., No. Ill., com.	Q	1.5 %	May 1
Pub. Serv., No. Ill., pf.	Q	1.5 %	May 1
Puget Sound Trac., Lt. & Pw., pf.	Q	.75%	Apr. 15
West. States Gas & Elec., pf.	Q	1.75%	Apr. 15

Reports of Earnings.

CAROLINA POWER & LIGHT.

Carolina Power & Light Company, together with its subsidiaries, Yadkin River Power Company and Asheville Power &

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Apr. 3	Mar. 27
American Tel. & Tel. (New York)	127	130¼
Commonwealth Edison (Chicago)	146	146
Edison Electric Illuminating (Boston)	243½	246½
Electric Storage Battery common (Philadelphia)	61½	61⅞
Electric Storage Battery preferred (Philadelphia)	61½	61⅞
General Electric (New York)	166	167
Kings County Electric (New York)	129	129
Massachusetts Electric common (Boston)	7	8
Massachusetts Electric preferred (Boston)	35½	35½
National Carbon common (Chicago)	180	—
National Carbon preferred (Chicago)	122	—
New England Telephone (Boston)	136	137½
Philadelphia Electric (Philadelphia)	—	27⅝
Postal Telegraph and Cables common (New York)	78¼	78
Postal Telegraph and Cables preferred (New York)	68	67½
Western Union (New York)	91	89½
Westinghouse common (New York)	65	65⅝
Westinghouse preferred (New York)	74	75

Light Company, reports as follows for the fiscal year ended December 31, 1915:

	1915	1914
Gross earnings	$1,363,693	$1,284,985
Expenses and taxes	673,731	673,589
Net earnings	689,962	611,396
Interest on bonds	361,300	345,958
Other interest and disbursements	51,215	46,590
Surplus	277,447	218,848
Preferred dividends	91,591	86,384
Balance	185,856	132,464

AMERICAN POWER & LIGHT.
(Combined earnings of subsidiary companies.)

	1916	1915
February gross	$ 691,989	$ 620,957
Net after taxes	327,018	283,410
Six months' gross	3,998,367	3,804,794
Net after taxes	1,941,961	1,840,554
Twelve months' gross	7,450,235	7,093,449
Net after taxes	3,522,716	3,329,770

KEYSTONE TELEPHONE.

	1916	1915
February gross	$117,725	$108,719
Net	59,183	54,461
Surplus	31,730	28,125
Two months' gross	234,834	218,606
Net	117,894	109,400
Surplus	69,288	62,976

CUMBERLAND TELEPHONE & TELEGRAPH.

The Cumberland Telephone & Telegraph Company reports for the year ended December 31, 1915, compared as follows:

	1915	1914
Operating revenue	$7,880,374	$8,048,552
Expenses and taxes	5,833,647	6,247,817
Operating income	2,046,727	1,800,735
Other income	133,940	153,697
Total income	2,180,667	1,954,432
Charges	1,300,089	1,269,230
Surplus	880,578	685,202
Dividends	664,809	664,809
Surplus	215,769	20,393
Miscellaneous deductions	102,096	150,777
Surplus	113,673	*130,384

*Deficit.

PACIFIC LIGHT & POWER.

Pacific Light & Power Company reports income account for fiscal year ended December 31, 1915:

	1915.	1914.
Gross earnings	$3,049,745	$2,825,263
Expenses and taxes	983,385	1,027,175
Net earnings	2,066,360	1,798,078
Interest funded debt	1,095,074	965,992
Interest on floating debt	201,175	292,964
Amortization	61,525	49,524
Surplus	708,586	489,868

Improvement in revenue, the annual report says, was largely attributable to the efforts of the new business department as shown by a gain of 22.41 per cent in commercial light earnings over the preceding year. Further economies in operating expenses were effected, of which about $75,000 was due to operation of the Big Creek hydroelectric development.

AMERICAN GAS & ELECTRIC.

American Gas & Electric Company, for the year ended December 31, 1915, reported the following income account:

	1915.	1914.
Gross of subsidiaries	$5,006,020	$4,368,883
Balance subsidiary earn. accruing to American Gas & Electric after deductions	1,307,942	1,016,919
Other income	452,829	113,920
Total income	1,760,771	1,130,839
Int. and other charges	708,657	335,636
Preferred dividends	101,283	100,884
Surplus	*950,831	694,319

*Equivalent to 25.6 per cent on the common stock, as compared with 19 per cent in 1914.

ILLINOIS NORTHERN UTILITIES.

Illinois Northern Utilities Company reports income account for the fiscal year ended December 31, 1915:

	1915.	1914.
Gross earnings	$882,554	$886,882
Expenses and taxes	500,413	547,575
Net earnings	382,142	339,307
Interest charges	216,954	176,154
Preferred dividends	108,480	108,480
Surplus	56,707	54,673
Previous surplus	116,598	
Common dividends, 1915	46,350	
Power and light surplus December 31, 1915	126,956	

Causes of decreased earnings for 1915 were depressed business conditions, unfavorable crop conditions in the territory served, and the quarantine for the foot-and-mouth disease in cattle. In the year 1,200 new customers were added and four street-lighting contracts secured. Additions of 14 miles to the transmission lines and 1.5 miles to the street railways were made. The outlook for 1916 is stated to be most promising.

AMERICAN CITIES COMPANY.

The American Cities Company has issued its report for the year ended December 31, 1915. The combined income account compares as follows:

	1915.	1914.
Gross earnings	$14,203,898	$14,822,105
Expenses and taxes	9,171,021	9,133,582
Net	5,032,877	5,688,523
Interest, etc	3,651,442	3,480,973
Surplus	1,381,435	2,207,550

The income account of the American Cities Company, proper, for the year ended December 31, 1915, compares as follows:

	1915.	1914.
Total income	$1,405,089	$1,928,677
Expenses, taxes, etc	227,259	94,868
Net	1,177,830	1,833,808
Interest	500,000	500,000
Surplus	677,830	1,333,808
Preferred dividends	616,605	1,233,210
Surplus	61,225	100,598
Previous surplus	291,465	194,994
Miscellaneous deductions	.....	4,127
Total surplus	352,690	291,465

WESTERN STATES GAS & ELECTRIC COMPANY.

An increase of 8.2 per cent is shown in the net earnings for the year ended February 29, 1916, as compared with the corresponding period of the previous year, while the increase in gross for the twelve months was 5.7 per cent. Comparative figures are reported as follows:

	1916.	1915.
Gross earnings	$1,198,253	$1,134,114
Net earnings	581,589	537,095

CANADIAN WESTINGHOUSE.

The Canadian Westinghouse Company, Ltd., reports for the year ending December 31, 1915, compared as follows:

	1915	1914
Net earnings	$ 860,628	$ 386,114
Interest	.....	5,626
Balance	860,628	380,488
Dividends	449,343	349,489
Surplus	411,285	31,000
Previous surplus	1,562,490	1,531,491
Total surplus	1,973,775	1,562,490
Written off property and plant	150,000	.....
Profit and loss surplus	1,823,775	1,562,490

PUBLIC SERVICE CORPORATION.

The Public Service Corporation of New Jersey and affiliated companies report for the year ended December 31, 1915, compared as follows:

	1915	1914
Gross revenue	$41,242,110	$38,760,260
Expenses, taxes and amortization	22,094,678	21,196,317
Net revenue	19,147,432	17,563,943
Charges, etc	17,176,180	15,938,606
Surplus	* 1,971,252	1,625,337

*Equal to 7.88 per cent earned on $25,000,000 capital stock against 6.5 per cent earned on same stock previous year.

Proposals

ELECTRIC LIGHTING AND POWER SYSTEM.—Bids will be received until 10 a. m., April 18, for the erection complete of a waterworks and electric lighting and power system at Lake Norden, S. D. Address R. C. Byrde.

WIRE AND CABLE.—Sealed proposals will be received by the South Park Commissioners, Fifty-seventh Street and Cottage Grove Avenue, Chicago, Ill., until April 12, for lead-covered cable and rubber-covered wire, to be used in connection with the lighting of Grant Park. J. F. Neil, secretary of the South Park Commissioners.

MOTORS.—Sealed proposals will be received April 11 at room 406, City Hall, Chicago, Ill., for furnishing and delivering to the Marshall Boulevard Municipal Plant, West Thirty-first Street and South Sacramento Avenue, 13 direct-current, shunt-wound, 230-volt motors, and one direct-current, compound-wound, 115-volt motor, according to plans and specifications on file in the office of the Department of Public Works. W. R. Moorhouse, Commissioner of Public Works.

ELECTRICAL SUPPLIES.—Bids will be received at the Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., for furnishing supplies at the following naval stations: Schedule 9476, Philadelphia, Pa., 14 remote-control starting appliances; Boston, Mass., one motor-generator set; Brooklyn, N. Y., two motor-generator sets. Bidders desiring to submit proposals should make application immediately for schedules to the Bureau, or to the Purchasing Office nearest to navy yard where delivery is to be made.

New Publications

RAILROAD ELECTRIFICATION.—The Chicago, Milwaukee & St. Paul Railway has issued an attractive pamphlet entitled "The Dawn of the Electrical Era in Railroading." This gives an illustrated description in popular style of the electrification of the mountain district of this railroad between Harlowton, Mont., and Avery, Idaho.

ELECTRIC RAILWAYS. — Technologic Paper No. 62 of the Bureau of Standards, Washington, D. C., is entitled "Modern Practice in the Construction and Maintenance of Rail Joints and Bonds in Electric Railways" by E. R. Shepard. Data have been collected from a large number of operating companies and analyzed, and some experimental tests are given. No. 63 is entitled "Leakage of Currents from Electric Railways" by Burton McCollum and K. H. Logan. This subject is discussed mathematically and the resulting equations interpreted.

PHOTOMETRY AND LIFE TESTING.—The Bureau of Standards, Washington, D. C., has issued several scientific papers dealing with these subjects. No. 264 is entitled "Photometry of the Gas-Filled Lamp" by G. W. Middlekauff and J. F. Skogland. This tells of the special problems involved in handling this type of lamp. No. 265 deals with "Life Testing of Incandescent Lamps" and describes the methods and equipment used at the Bureau. No. 263 gives a formula for calculating the illumination at any point received from a radiating disk. The author is Paul D. Foote. No. 261 is entitled "Studies of Instruments for Measuring Radiant Energy in Absolute Value," by W. W. Coblentz and W. D. Emerson.

Electrical Patents Issued March 28, 1916

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,176,739. Junction-Box. C. W. Davis, assignor to Standard Underground Cable Co., Pittsburgh, Pa. For multiple-conductor cables.

1,176,759. Telephone-Key. W. Kaisling, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Combination of plungers and rocking-lever operating sets of contacts.

1,176,762. Electric Spot-Welding Apparatus. L. S. Lachman, New York, N. Y. Transformer arrangement.

1,176,767. Trolley-Operated Contact. J. F. McElroy, Albany, N. Y., assignor to Consolidated Car-Heating Co. Mounted on wire suspension and operated by upward pressure of passing trolley.

1,176,794. Ignition Device. H. W. Uhl, Freeport, N. Y. Interrupter structure.

1,176,801. Insulator. W. H. Williams, Carey, O. Cleat.

1,176,805. Magneto Machine. H. H. Wixon, assignor to Stromberg Motor Devices Co., Chicago, Ill. Movable inductor, with stationary armature winding which can be easily removed.

1,176,809. Automatic Fire-Alarm. H. Barton and F. Barton, Endicott, N. Y. Circuit controlled by tilting mercury contactor normally restrained by combustible cord.

1,176,814. Electric Heater. F. O. Bul-

lis, assignor to Lektric Sales Co., Louisville, Ky. Special casing and support.

1,176,824. Telegraphic Typewriting System. P. Etienne, St. Imier, Switzerland, assignor of one-half to B. Burchardt, Berlin, Germany, and one-tenth to F. Aldendorff, Schmargendorf, Germany. Operated by current impulses.

1,176,829. Motor-Controller. C. T. Henderson, assignor to the Cutler-Hammer Mfg. Co., Milwaukee, Wis. Combination of master and reversing switches with power-operated main switch.

1,176,900. Sanitary Telephone Mouthpiece. E. M. Jenkins, Italy, Tex. Specially adapted for treating with disinfecting fluid.

1,176,908. Safety Cranking-Device for Engines. G. A. Kuntz, Des Moines, Iowa. Prevents connection of crank when spark advanced.

1,176,919. Timekeeper Device. D. Nemeth, New York, N. Y. Clock sound and buzzer recorder by phonograph.

1,176,925. Apparatus for Radio Communication. G. W. Pickard, assignor to Wireless Specialty Apparatus Co., Boston, Mass. Receiver testing apparatus.

1,176,927. Pin for Electrical Work. M. C. Rosenfeld, Cleveland, O. For supporting insulators, etc.

1,176,941. Automatic Switch. W. L. Bliss, assignor to The United States Light & Heat Corp., Niagara Falls, N. Y. Electromagnetically operated.

1,176,942. Electrical Terminal Connection. W. L. Bliss, assignor to The United States Light & Heat Corp. For batteries.

1,176,943. Automobile Tail-Signal Switch. F. Bollinger, Akron, O. For controlling pair of tail-lights.

1,176,944. Electrical Switching Apparatus. E. W. Brackett, assignor to The Garford Mfg. Co., Elyria, O. Telephone key.

1,176,960. Time-Stamp Construction and System of Operation for the Same. C. I. Hall, assignor to Minerallac Electric Co., Chicago, Ill. Electric time-recorder, comprising a constant-speed motor.

1,176,970. Secondary Battery. J. O. Luthy, San Antonio, Tex. Dry battery has paste of plaster-of-paris and sulfuric acid as electrolyte.

1,176,984. Electric Switch. A. C. Philpott, Bucyrus, O. Details of electromagnetic switch.

1,177,016. Switch. H. W. Cheney, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Oil switch.

1,177,043. Ignition Apparatus. W. B. McLaughlin, Brooklyn, N. Y. Structure of spark plug.

1,177,044. Multiple-Brush Switch. J. L. McQuarrie, assignor to Western Electric Co. For telephone exchange.

1,177,047. Machine for Transmitting Sound Over Long Distances. W. Opel, Leipzig, Germany. Special heat-insulated microphone.

1,177,076. Lamp. W. H. White, Kenosha, Wis. Special enclosing structure for incandescent lamp.

1,177,081. Railway-Signal Apparatus. J. H. Alandar, Chicago, Ill. Vehicle signals operated by track devices.

1,177,082. Electrical Cooking Utensil. A. B. Antisell, assignor to H. E. Gibson Co., New York, N. Y. Has heat-insulating vacuum chamber. (See cut.)

1,177,119. Composition of Matter and Process of Making the Same. A. J. Liebmann, New York, N. Y. Electric contact containing powdered tungsten.

1,177,139. Perforator for Master Sheets. L. R. Roberts, assignor to Underwood Typewriter Co., New York, N. Y. Electromagnetically operated.

1,177,180. Grounding Device. W. R. Garton, Brooklyn, N. Y. For lightning rods, etc.

1,177,211. Combination Level and Flash-Light. T. W. Ridpath, Kansas City, Mo. Special arrangement of battery, lamp, etc.

1,177,227. Stop Mechanism for Phonographs. F. S. Boerries, Paris, France. Disk controls motor circuit.

1,177,229. Time Switch. C. E. Campbell, Lynn, Mass. Clock-controlled.

1,177,239. Attachment for Pull Electric-Lamp Sockets. T. W. Fitzgerald, Boston, Mass. Guide for chain extends from socket.

1,177,241. Searchlight for an Umbrella or Cane Handle. S. S. Gay, Sedro Woolley, Wash. Arrangement of lamp, switch, etc.

1,177,253. Electric Heating Device. J. Lawrence, assignor to S. G. Ranger, New York, N. Y. Structure of stove top.

1,177,254. Electric Heater. J. Lawrence, assignor to S. G. Ranger, New York, N. Y. Special structure of heating unit.

1,177,260. Apparatus for Electric Welding. T. E. Murray, New York, N. Y. Resistance type, having roller electrode.

1,177,271. Telegraph System. P. M. Rainey, assignor to Western Electric Co., New York, N. Y. Automatic call-distributing system at central office.

1,177,279. Time Switch. F. Smid, Jr., Philadelphia, Pa. Clock-controlled.

1,177,280. Automobile Torpedo. B. H. Scott, Mishawaka, Ind. Exploded by electric arc.

1,177,286. Telephone-Pad Attachment. C. B. Starbird, New York, N. Y. For securing pad to desk set.

1,177,307. Switchboard Connecting-Cord and the Like. P. P. Craven, Charlton-on-Medlock, Manchester, England. Connection of plug to cord.

1,177,310. Fuse Box. H. F. Fisher, Columbus, O. For high-tension conductors.

1,177,312. Spark-Coil Vibrator. M. Fulton, assignor to Jefferson Electric Mfg. Co., Chicago, Ill. Details of vibrator and contacts.

1,177,315. Insulator. W. G. Gee, Kansas City, Mo., assignor of one-half to W. A. Snapp, Dunlap, Mo. Pin type.

1,177,319. Electric-Lamp Socket. G. W. Goodridge, and G. B. Thomas, assignors to The Bryant Electric Co., Bridgeport, Conn. Special with one-piece metallic casing.

1,177,324. Refracting and Diffusing Container for Incandescent Lights. P. C. Hewitt, Ringwood Manor, N. J. Structure of bulb.

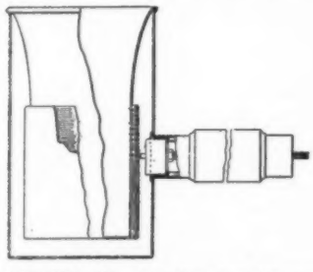
1,177,325. Refracting Container for Illuminating Means. P. C. Hewitt, Ringwood Manor, N. J. Modification of above.

1,177,326. Method of Making Refracting and Diffusing Containers for Incandescent Lights. P. C. Hewitt, Ringwood Manor, N. J. Related to above.

1,177,328. Electric Storage Battery. H. H. Hirsch, Philadelphia, Pa. Details of construction.

1,177,334. Protective Device. R. P. Jackson, assignor to Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa. Transformer disconnecting arrangement.

1,177,335. Electrolytic Lightning Arrester. R. P. Jackson, assignor to Westinghouse Elec. & Mfg. Co. Comprises two electrolytic cells connected in different relations.



No. 1,177,082.—Electric Cooking Utensil.

1,177,336. Lightning Arrester. R. P. Jackson, assignor to Westinghouse Elec. & Mfg. Co. Horn-gap device.

1,177,346. Coil Terminal. J. E. Mateer, assignor to Westinghouse Electric & Mfg. Co. Details of single-piece device.

1,177,349. Induction Regulator. C. B. Mills, assignor to Westinghouse Elec. & Mfg. Co. Motor arrangements for adjusting regulating member.

1,177,354. Line Insulator. D. P. Ronsom, Woodstock, Vt. Suspension type.

1,177,370. Electrical System for Automobiles. R. Varley, assignor to Varley Duplex Magnet Co., Jersey City, N. J. Combination of lighting and ignition generators.

1,177,377. Railway Signaling. J. P. Buchanan, Cleveland, O., assignor of one-half to F. B. Wiegand, Cleveland, O. Relay arrangement for block system.

1,177,392. Sheathed Wire Terminal. J. T. H. Dempster, assignor to General Electric Co., Schenectady, N. Y. Terminal for insulated armored wire.

1,177,400. Support for Electric Wires. R. B. Duran, Torreon, Mex. Trolley-wire suspension.

1,177,416. Electromagnetically Controlled Mercury Vapor Lamp and the Like. J. Jonas, assignor to Aktiengesellschaft Brown Boveri & Cie Baden, Switzerland. Arc manipulated by magnetism.

1,177,420. Signaling Horn. J. A. Lannert and E. L. Lannert, East Cleveland, O. Diaphragm operated by electromagnet.

1,177,421 and 1,177,422. Electric Towing-Locomotive. C. W. Larson, assignor to General Electric Co., Schenectady, N. Y. First patent: Frame structure, gearing, etc. Second patent: modification.

1,177,427. Electromagnetic Switch. R. H. McLain, assignor to General Electric Co. For alternating-current circuits.

1,177,444. Electric Meter. W. H. Pratt, assignor to General Electric Co. Structure of damping magnet.

1,177,447. Lamp. G. Richards, Downsville, Wis. Magnetically operated flame extinguisher for oil lamp.

1,177,448. Fraud-Preventing Device. J. H. Rosko, Johnstown, Pa. Handcuffs grip operator when alarm box is used.

1,177,455. Telephone. H. Thompson, Bailliieboro, South Monaghan, Ontario, Canada. Has signal auxiliary to ringer.

1,177,485. Telephone Signal. DeForrest Champeon, Houlton, Me. Audible signal near transmitter controlled by receiver arm.

1,177,496. Ignition System for Hydrocarbon Engines. L. Davis, Rich Hill, Mo., assignor of one-half to I. L. Wierick, Rich Hill, Mo. Details of timer, coil, etc.

1,177,517. Trolley Mounting. G. E. Henry, Vincennes, Ind. Harp structure.

1,177,530. Motor-Vehicle Signal. B. A. Melvin, Sacramento, Cal. Lamp mounted on signal blade.

1,177,547. Storage Battery. A. H. Snyder and R. L. Buck, assignors to Gould Storage Battery Co., New York, N. Y. Structure of jar cover.

1,177,548. Rectifier. J. E. Southwick, Atlantic, Iowa. Centrifugally controlled commutating arrangement.

1,177,551. Electric Railway System. J. B. Strauss, Chicago, Ill. Surface contact system.

Reissue 14,096. Automatic Trunking System. E. A. Mellinger, assignor to Automatic Electric Co., Chicago, Ill. Original No. 1,110,071, dated Sept. 8, 1914. For telephone exchanges.

PATENTS EXPIRED.

The following United States electrical patents expired on April 4, 1916:

622,207. Driving Mechanism. H. B. Collins, Fulton, N. Y.

622,210. Apparatus for Illustrating Phenomena of Thunder and Lightning. W. Dodd and A. D. Struthers, Des Moines, Iowa.

622,214. Trolley Wheel. S. W. Fletcher, Lowell Mass.

622,225. Water Guard for Trolley Ropes of Poles. T. Hawken, Rockand, Me.

622,230. Controlling Switch for Electric Motors. R. Hutchinson, Mobile, Ala.

622,268. Telephone Switchboard System and Annunciator. G. B. Rodgers, Knoxville, Tenn.

622,328. Magneto Ear-Phone. F. H. Collins, Everett, Mass.

622,355. Electric Elevator. T. W. Heermans, Evanston, and N. Whichello, Chicago, Ill.

622,369. Controlling Switch for Electric Motors. R. Hutchinson, Mobile, Ala.

622,392. Method of and Means for Operating Electric Motors. C. J. Reed, Philadelphia, Pa.

622,298. Electric Steering Apparatus for Vessels. G. Sautter, Paris, France.

622,412. Telephone Cabinet and Support. P. W. Bossart, Marietta, Pa.

622,413. Granular Electrode and Process of Treating Same. P. W. Bossart, Marietta, Pa.

622,430. Electric Elevator. T. W. Heermans, Evanston, and N. Whichello.

622,450. Insulating Material. J. DeLong, New York, N. Y.

622,452. Magneto-Electric Motor-Dynamo. F. H. Donaldson, Garvanza, Cal.

622,466. Electric Railway or Tramway. J. J. Geilmann, Paris, France.

622,472. Typewriting Machine. W. T. Hoofnagle, Baltimore, Md.

622,481. Means for Securing Electrical Unity of Systems of Metallic Pipes or Mains. D. C. Jackson, Madison, Wis.

622,596. Apparatus for Holding and Connecting Guard Wires of Electric Cables or Other Wires. R. Bostock and F. A. Cheetham, Brighouse, England.

622,606. Contact for Controllers. G. H. Condict, New York, N. Y.

622,607. Electrical Advertising Machine. H. W. Cox, Nottingham, England.

622,609. Carbon Brushholder. R. E. Crockett, Michigan City, Ind.

622,618. System for Overhead Electric Wires. W. Glasgow, Chicago, Ill.

622,627. Resistance and Contact Apparatus for Electric Currents. H. Lyon, Glasgow, Scotland.

622,628. Resistance and Contact Apparatus for Electric Currents. H. Lyon.

622,629. Multiple Telegraph. E. J. P. Mercadier and H. R. J. Periquin, Paris, France.

622,636. System of Multiplex Telegraphy. H. A. Rowland, Baltimore, Md.

622,639. Electric Meter. G. A. Scheeffer, Peoria, Ill.

622,645. Electroharmonic Signaling Apparatus for Telephone Systems. F. H. Brown, Chicago, Ill.

622,646. Electric Signaling Apparatus for Telephone Systems. F. H. Brown.